OUTLINE FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) SCOPE-OF-WORK UNDER CERCLA/SARA

1.0 Site Description, Project Planning Overview and Objectives

1.1 Site Description

1.1.1 Site Background

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In this section, briefly summarize the physical features of the site, nature and extent of chemical contamination, operational history and past use of the site, based on available information. Describe how past activities may have led to existing contamination, referring to other reports for detailed discussions. It is important to describe any processes, e.g. degreasing, electroplating, as well as suspected disposal activities which may have occurred at the site. Also discuss operations and activities off site that may have contributed to the contamination. This information should be distributed and discussed with the team prior to preparation of the scope. If not thoroughly researched previously, this should be the first task to be performed by the Contractor in the RI.
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1.1.2. Previous Studies

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Review previous studies conducted at the site, and summarize key information in this section of the scope. Key information should include the regulatory history of the site, the program (IRP, FUDS, DOE...) under which the study was conducted, as well as phase of study relative to site closeout. Briefly summarize the time line of the activities performed previously, as well as those anticipated to achieve site closeout. Describe the primary contribution of previous studies, including data describing the nature and extent of contamination, operational history, and preliminary risk analysis, relative to this phase of the study. Include Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ATSDR) Health Assessment summary, if available. Conjecture briefly how previously gathered data can be used as well as supplemented by data requirements described in this SOW. The reports and other

available documents should be referenced under Section 1.6 (References).
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1.1.3 Regulatory Authorities

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Include appropriate references to regulatory program/authority under which the site is now being addressed (i.e. CERCLA/SARA, Executive Order 12088, the National Contingency Plan, NEPA, any IAGs, Federal Facility Agreements, CERCLA 104 orders, AR 200-1, etc.). Indicate which agency is the lead agency. Indicate whether agency such as AEHA has review/approval authority for submittals under the Surgeon General. Indicate whether there are any state mini-Superfund laws applicable at this site, which are in addition to federal requirements, rather than in lieu of existing federal regulatory requirements. There are no provisions in federal CERCLA for transfer authority; the federal EPA cannot transfer CERCLA authority to the states. Therefore some states will write, then adopt, their own mini-Superfund law. This section can be prepared by any team member with an environmental regulatory background.
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1.2 Project Planning Overview and Objectives

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This section essentially consists of project objectives, site strategy information, and data needs criteria, rather than directives, provided to the Contractor as a result of technical project planning efforts.

The quality of any individual study performed will be dependent upon the set of data available to site decision makers to support decisions leading to site closeout. The technical project planning team, in accordance with ER 5-7-l(FR), Project Management, is responsible for defining the quality of investigations and design submittals prepared under the HTRW program. A practical method in measuring and defining quality in the HTRW program, is through adequate planning, and development of quality goals or objectives. The use of HTRW technical project planning guidance in development of these goals or objectives for data collection design is strongly encouraged.

The USACE project team involved in scope preparation should consist of decision makers, data users, and data collection support personnel. Decision makers are defined as Executive

Agency representatives, Customer MACOM and installation representatives, USACE project and technical managers, and representatives from affected regulatory agencies.

Data users include technical support personnel such as designers, regulatory specialists, individuals responsible for worker health and safety, and risk assessors. Data collection support personnel will probably include chemists, geologists, biologists, statisticians, industrial hygienists, and engineers.

Each member of the project planning team will contribute in defining data collection requirements or needs and methods of collecting data to fulfill those needs, which will allow decision makers to properly evaluate information in making project/site decisions. Information concerning individual project team representative's contribution to scope preparation will be defined further in subsequent sections of this guidance.
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1.2.1 Site Strategy Development

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Site Strategy development is the determination by the project planning team of long term objectives for the site for overall execution, and specific data needs, to achieve site closeout. Using existing information gathered by the TM, described in Section 1.1, concerning the applicable regulatory program, historical data and operational history, previous reports, and information constraints such as schedule and budget for the project, the team will attempt to define overall strategy for the site. The developed strategy determines the opportunities and options for characterizing and remediating portions of the site under an accelerated schedule, operable unit specification, and preliminary determination of critical elements to be included in each phase of execution planned to achieve site closeout. This long term evaluation of site strategy will enable the team to identify general data needs associated with each phase of project execution, and initially consider the most effective/plausible means of proceeding with future characterization and remediation plans. The team may want to consider the possibility of collecting data to support future phase execution data needs early on, to eliminate possible future project delays, and allow them some predictive ability in determining possible data needs to support future site decisions. Strategy development will be dependent on or a function of the information provided by the customer regarding schedule

and available funding for the single phase project execution, and projections for future funding and schedule requirements.

The team may or may not wish to include details of the site strategy development, other than general information as it pertains to the specific project, in this section of the SOW. Specification of strategy goals will depend on the sensitive nature of the information, and the Contractor's "need to know" to effectively carry out team quality goals and requirements.
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1.2.2 Project Objectives and Project Decision Statements

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The strategy developed for the site as a whole, enables the project team to focus resources on data needs in support of site decisions for the specific phase of project execution, or project objectives/project decision statements. Minimally, these project specific statements should be included in this section of the SOW.

Examples of project decision statements include:

RI - Media-specific contamination determined to pose an unacceptable risk to identified current or potential future receptors from potential exposures to site wastes, will require the development of remediation goals to reduce or eliminate health risks.

FS - Alternatives will be identified and screened which will contribute to reduction of health risk and compliance with ARAR’s, as is technically feasible and cost effective.

General project objectives, or phase execution requirements, to be considered in the determining data needs for the RI/FS are;

- degree of risk to human health and the environment
- degree of regulatory compliance
- liability
- feasibility of remedial alternatives

Data needed to evaluate each of these project objectives or in support of decision statements for the RI/FS generally coincide with data required to support the baseline risk assessment, feasibility study, regulatory compliance evaluation, and liability.

Use of conceptual site models will aid the team in determining the data needs associated with each of these categories. The team may summarize the results of the conceptual site model evaluation in this section of the SOW, and minimally define data needs, as preliminary criteria to support determination of data quality objectives.
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1.2.3 Data Quality Objectives

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This section should provide a brief summary of project team's efforts in defining data quality objectives. The team is encouraged to use the USACE project planning guidance, to develop these formal project objective statements. Carefully crafted objectives, developed by the project planning team, are the product of:

- the site strategy planning analysis
- the project specific strategy development,
- conceptual site model development
- data need determination and
- data collection design evaluation.

Objectives define the quality of data required to support project decisions, and the maximum level of uncertainty that is acceptable in the data. These efforts provide the criteria for specification and collection of technically sound and defensible data, to be used to support project decisions and contribute to site closeout.

Information from Section 1.2.1, Site Strategy Development, and Section 1.2.2, Project Decision Statements, are used in conjunction with criteria for data collection design specified in RI/FS SOW Sections 2.3 and 2.4, in determining the overall data quality objectives.

An example of a Data Quality Objective Statement which the planning team might develop, in support of these data needs, for this section of the SOW could be:

> "Sufficient groundwater samples shall be collected from the shallow aquifer to: allow a minimum detectable difference of 20% with associated minimum confidence interval of 80%; in support of the quantitative risk characterization evaluations for the site."

The statement reflects the planning team's collective effort

to define characteristics of the intended use of the data, and the means to achieve that intended use. The quantity, quality, and type of data specified becomes a function of required confidence, decision maker's and data user's requirements, schedule, and funding.

Data Collection Design specifications and planning rationale used in defining the data quality objectives are further defined in the Field Investigation and Data Analysis sections, Tasks 3 and 4 of the RI/FS SOW outline.

The effort expended by the project planning team to develop these initial or preliminary data quality objectives, will provide a quantifiable means to identify and measure quality of the products of the HTRW program. The Contractor becomes a participant in this process of quality assurance by expanding on and implementing these goals or objectives in preparing workplans, and reports for the study.
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1.3 Summary of RI/FS Tasks

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Give only a superficial listing of tasks to be performed under this SOW. Details of each to follow.
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Task 1 - Contractor Workplan Preparation
Task 2 - Community Relations
Task 3 - Field Investigations
Task 4 - Sample Analyses, Data Assessment/Validation and Reporting
Task 5 - Data Evaluation/Fate and Transport Analysis
Task 6 - Baseline Risk Assessment
Task 7 - RI Report
Task 8 - Remedial Alternative Development and Screening
Task 9 - Treatability Studies and Treatability Study Reports
Task 10- Detailed Analysis of Alternatives
Task 11- FS Report
Task 12- Post RI/FS Support

1.4 References

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Include citations of previous reports, guidance documents

such as Conducting Remedial Investigations/Feasibility Studies under CERCLA, DA PAM 40-578, USACE guidance, Risk Assessment Guidance for Superfund, ATSDR Health Assessments, etc. Include any Federal Facility Agreements, Interagency Agreements, Consent Orders, Compliance Orders, and a description of effects of these agreements/schedules on execution of the project, such as mandatory review periods, primary document submittals, regulatory requirements, and special considerations. List only those documents the project team possesses or can locate. Those being provided to the Contractor should be noted.
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2. Project Requirements

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Under this section, the efforts required of the Contractor are discussed. When tasking the Contractor make sure it is clearly explained what is expected.
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2.1 Task 1 Contractor Workplan Preparation

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Planning documents to be produced by the Contractor include the general Project Workplan, with attachments for the Site Safety and Health Plan (SSHP), the Chemical Data Acquisition Plan (CDAP), Monitoring Well Installation and Drilling Plan (MWIP), and Community Relations Plan (CRP). A treatability study workplan attachment may also be required. The advantage of the single planning document approach;

- promotes consistency,
- acknowledges and advocates the interdependence and interaction of specific plan requirements,
- and alleviates reproduction of redundant information.

The single workplan document also provides all project team members, regulators, and customers with all pertinent project information in a single submittal, promoting a wider review of submittals and subsequent acceptance of plan requirements. The information included in Section 1.0, and in subsequent sections of the SOW, regarding site description, evaluation of existing data, data quality objectives, and sample collection design should be discussed in sufficient detail to allow the Contractor to properly evaluate and implement project team requirements when preparing implementation plan attachments.

Note: Ideally, the USACE project planning team should develop the project data quality objectives, and data collection design requirements, which may be expanded on by the Contractor in plans and reports. However, an option which could be exercised would be to issue a work order directing the Contractor to prepare the Data Quality Objectives in the project workplan. Following a consensus of agreement by the planning team, a separate work order for field work requirements and report preparation would be issued, based on these objectives. The Contractor, with participation from USACE planning team representatives, should be directed to use the USACE project planning guidance, in developing the data quality objectives and in preparing the project workplan.

Elements of the general workplan, should include introductory information, such as site physical description, and existing chemical data, evaluation of existing data, project objectives, data quality objectives, and data collection design requirements. The plan attachments, such as the CDAP and MWIP, are specific instructions designed to implement data collection design requirements in carrying out these objectives. The supplemental individual plan attachments should not reiterate the introductory information or project objectives included in the main workplan.

Data collection design information and instructions to the Contractor are included under Tasks 3 and 4 of the SOW.
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2.1.1 Available Data Review

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The information reviewed by the project team in determining site and project strategy and objectives, shall be made available to the Contractor, in the form of previous reports, records, and guidance documents. This section describes the requirements for the Contractor to collect and evaluate available information on the site, including existing chemical data, operational history information, physical characteristics of the site, as well as project team site strategy development summary, project decision statements, as stated in paragraphs in Section 1. of the SOW. This section should be prepared by the team as a whole, with input as appropriate from regulators and the customer.

Note: Evaluation of existing data should consider treatment of data relative to elements discussed in detail under Section 2.4, Sample Analyses, Data Assessment/Validation and Re-

porting and Section 2.5, Data Evaluation/Fate and Transport.
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2.1.1.1 Review Previous Reports/Data
2.1.1.2 Background Information/Site History
2.1.2 Background Data Collection
2.1.2.1 Literature Searches and Air Photo Survey
2.1.2.2 Interviews

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This section would require the Contractor to conduct appropriate interviews (most likely by phone) with persons knowledgeable about the site. This section would most likely be prepared by the project manager. Coordination would be required with the installation or facility to develop a starting list of persons to be contacted. Research to identify past employees or others knowledgeable of the site history may be required of the Contractor.
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2.1.2.3 History of Regulatory, Response Actions

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It is important that the Contractor gather sufficient information to construct the compliance background for the site, which will be recorded in the project workplan, and other site reports. Here, the Contractor would be tasked to gather enforcement type documents, enforcement orders, ATSDR health assessments, state inspection reports, etc., in describing the regulatory history in the project workplan. The project manager, regulatory specialist, or designee should prepare this section of the SOW, with the input of the installation, if appropriate.
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2.1.2.4 Domestic/Industrial/Municipal Well, Surface Water Intake Inventory

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This section would require the Contractor to develop this data group by performing a survey of the existing wells and surface water intakes in the vicinity of the site(s) in accordance with the Domestic/Industrial/Municipal Well Inventory portion of the Geotechnical Requirements (6.5). This section should be developed with input from the hydrogeologist and team member responsible for review of the

risk assessment. This section should require the data be presented in the RI report. This work may require coordination with local utility officials, the installation, and state or local regulatory agencies, such as county health departments or state water resource agencies. This coordination can be entirely delegated to the Contractor.
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2.1.2.5 Site Boundaries Identification

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The Contractor should be required to develop a site map through a record search that will help to identify roads and property boundaries and owners. This will help to determine access requirements to the site or other property near the site. The information available would determine the detail of the site map. The Contractor should be tasked to do a survey to better define the site and surrounding area. This tasking should cross reference section 2.3.1 which requires generation of standard survey information and also property lines/boundaries at the site and near the vicinity of the site. The ability to acquire property may alter the alternative selected. Access to the site and surrounding area by the Contractor should be considered when scoping the RI/FS. Long lead times may be required. Rights of entry for access via private lands and roads are necessary and must be obtained by the Government prior to initiation of the field work. In areas of separately owned mineral rights, it may be necessary to obtain separate subsurface rights of entry. There should be a cross reference to the Project Management Section (3.5.2) discussing Government-furnished information if existing survey data and information on access rights are available. Reference to Section 6.1.11 (Site Surveying) may also be appropriate.
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2.1.3 Preliminary Site Visit
2.1.4 Preparation of Site Background Summary

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This section requires the information gathered by the Contractor under Section 2.1.2.2, and provided to the Contractor under Section 2.1.2.1. to be summarized in the introductory section of the main workplan. The Contractor should be required to include in this section of the workplan all available data gathered from data review, interviews, and site visits. The summary should include data concerning site history, regulatory status, liability, preliminary risk

analysis, physical features of the site, and nature and extent of chemical contamination. The general workplan introduction section should include elements such as:

- site history,
- physical features of the site,
- known extent of contamination,
- data evaluation of existing chemical data
- findings of any preliminary risk analysis,
- probable remedial alternatives,
- and regulatory status.

This information provides the basis for the site strategy, general project objectives, data quality objectives, and data collection requirements discussion in subsequent sections of the Workplan, and is the single source of background information referenced in the Workplan attachments. Consider the following format:

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2.1.4.1 Regional Setting
2.1.4.2 Site Physical Description
2.1.4.3 Operational History
2.1.4.4 History of Regulatory Response Act ions
2.1.4.5 Nature and Extent of Contamination
2.1.5 Development of Data Quality Objectives

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This section should require that site strategy and project specific objectives developed initially by the project planning team be expanded and discussed in the next section of the workplan by the Contractor. This section should reference workplan requirements included in USACE guidance on HTRW technical project planning in specifying Contractor contribution to planning requirements in defining Data Quality Objectives.

Data need categories for the RI/FS, defined as risk, liability, feasibility, and compliance, should be used with project constraints in constructing the framework for formal data quality objectives determination, and selecting the most appropriate data collection program.

In defining specific data groups from data needs, further development of conceptual models will be required, for each data need category. Information regarding level of accept-

able error or uncertainty, and confidence required for each data group shall be discussed by the Contractor in this section in developing the data quality objectives. Statistical analysis shall be used to define quantity and quality of samples required to meet uncertainty requirements.

Each constraint, cost and schedule, program requirements, shall be evaluated and discussed in this section in proposing specific objective statements.
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2.1.6 Data Collection Design

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This section should require that the Contractor discuss data collection design requirements in the workplan. The design requirements developed by the USACE team are presented in Tasks 3 and 4 of the SOW. The Contractor may be required to refine or develop the data collection program. The rationale used in devising the data collection program, or the means of achieving the data quality objectives, should be included in the Contractor's workplan.

The project planning team data collection support personnel, or data implementors, will initially define these data collection strategy requirements in tasks 3 and 4 of the SOW. Data collection strategy options include alternative designs in defining quantity of data collected, quality of analytical data, and types of samples required to support data needs within the specified range of confidence and within budget limitations.

Sampling methodology is determined for each data group, considering levels of uncertainty associated with data collection methods, chemical analysis, quantity, and sample location. The level of uncertainty is a function of the error; measurement error, systematic error, and random errors. Selection of the appropriate sampling method, number of samples, in suitable sampling locations, given cost and schedule constraints will reduce the error and/or uncertainty associated with a specific data collection design option. Statistical analysis is a useful, quantifiable method in evaluating the error and uncertainty, and should be used as directed in the HTRW technical project planning guidance in determining the elements for the most appropriate sample collection design program.

The outcome of the data collection options discussion should be to propose a data collection program which will meet spe-

cific data quality objectives for the project. All sample design and analytical requirements, QA/QC specified in defining data quality objectives shall be discussed by the Contractor in sufficient detail in the general project workplan, to allow reviewers to understand the criteria or reasoning used in selecting the specific data collection program. Adequate discussion shall be required in the workplan regarding how data collection design will meet data needs or data quality objectives to 1) allow for adequate evaluation of site risks, 2) alternative screening and development, and design, 3) regulatory compliance, and 4) liability, given project constraints, including the statistical basis for sufficiency, evaluation of uncertainty and specific numerical errors for confidence of data.

The methods by which data collection will be implemented such as sample collection techniques, chemical analyses, and well installation requirements will be described by the Contractor, in detail in the corresponding workplan attachments.
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2.1.7 Workplan RI/FS Report Requirements Discussion

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This section of the scope, rather than referencing a guidance document, would require that specific RI/FS report elements be described in the project workplan, and would specify the degree of treatment expected in plan preparation. For example, the project planning team may want the Contractor to indicate in the workplan what is to be included in the Risk Assessment portion of the RI/FS report, such as models used, and pathways evaluated. This added detail will allow the team to determine early on what is expected to be included in the RI/FS report, and to convey those expectations to the Contractor in comments on the plans, rather than by review of the actual reports. General report topics to be evaluated by the Contractor in the Workplan for report preparation include the following subtopics.
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2.1.7.1 Data Evaluation
2.1.7.2 Nature and Extent of Contamination
2.1.7.3 Fate and Transport
2.1.7.4 Risk Assessment
2.1.7.5 Preliminary Identification of ARARs and Preliminary Remediation Goals (PRGs)

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This section should require the Contractor to touch base with the regulators at this point to get a feel for any ARARs that may be applied to the site. This meeting or phone call should be coordinated and attended by the project manager, technical manager, or designated representative. Contractors shall not contact customers or regulators directly, without supervision of the USACE manager. Formal records of these discussions, such as a telephone record, and meeting notes, shall be prepared by the Contractor, and made available to USACE project/technical manager within a 10 day period.

Preliminary Remediation Goals are developed by the Contractor in the Project workplan, as general numeric evaluations of acceptable levels of contaminants in site media, based on probable site risks. These are determined by using default values, defined in Part B, of the Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation, and back calculating the allowable concentration, using a target risk value for the media of concern. These values will be used to preliminarily define remediation goals, general quantity of material which may require action, possible alternatives which may be proposed to meet these goals, and general cost of the response action. This step in the workplan preparation is important in providing decision makers with information concerning general site risks and probable response action, early in the study process, focusing resources, data collection, and evaluation efforts on pertinent project risk and design considerations.
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2.1.7.6 Development of Remedial Alternatives

2.1.8 Preparation of Workplan Attachments

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The technical requirements for the SSHP, CDAP, MWIP, and treatability study attachments are found in sections 4-6.
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2.1.8.1 Site Safety and Health Plan (SSHP) Attachment

2.1.8.2 Chemical Data Acquisition Plan (CDAP) Attachment

2.1.8.3 Monitoring Well Installation and Drilling Plan (MWIP) Attachment

2.1.8.4 Community Relation Plan (CRP) Attachment

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This section requires the Contractor to prepare a CRP attachment to the general workplan. The project manager should consider the sensitivity and political atmosphere of the site, the project, the contamination and the surrounding community when preparing this portion of the scope. EPA guidance can be used to assist the project manager in this task. See EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9230.03B, "Community Relations in Superfund". Cross reference Task 2, Community Relations.
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2.1.8.5 Treatability Study Workplan Attachment

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Refer to Enclosure 12 of the ETL for information concerning this plan.
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2.2 Task 2 Community Relations

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This section describes the required Contractor support for community relations, and is normally prepared by the project manager and risk assessor. Unless otherwise directed, the customer will take the lead in community relations. Coordinate with the customer to make sure they will take the lead. Ask the customer what level of community relations' support the Contractor will need to provide.
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2.2.1 Establishment of Repositories

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This section would outline the Contractor's responsibilities in establishing a document repository. As a note to the team, consider establishing a repository early. A repository is a place, such as the local library or the Corps/installation Public Affairs Office, where the administrative record is kept for public viewing. Do not wait to the last minute to scope this requirement. In the first scope, the project manager should at least start the Contractor on looking at the requirements and physical location of the repository. For NPL sites under the Superfund program, guidance by the EPA should be followed. The project manager would be best to develop this section in conjunction with the installation, if appropriate.
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2.2.2 Preparation of Community Relations Support

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The community relations support required by the Contractor can vary. The project manager needs to coordinate with the customer as to the level of support needed. The requirements should be clearly identified in the scope of work and clarified with the customer. A list of items for community relations activities and requirements are identified in the OSWER Directive identified in the above paragraph on community Relation Plan attachment to the project workplan. For CERCLA community relations requirements it is recommended that the OSWER Directive be used. This handbook was issued as policy and guidance for community relations in the Superfund program. This document identifies the requirements for community relations for various activities that may be conducted under this scope and is a good tool to identify what support may be needed from the Contractor and for a project to be a success.
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2.2.3 Preparation of Responsiveness Summary

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One item that may be required of the Contractor after the public meeting is a Responsiveness Summary. This should be coordinated with the customer and identified in the scope. This document provides responses to each of the significant comments, criticisms, and any new data submitted.
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2.3 Task 3 Field Investigations

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This section of the SOW should present specific information on the quantity and location(s) for various field activities and chemical sampling, based on the data collection options considered in defining project DQOs. Specifications for actual implementation of the activities are presented in sections 4-7 of the SOW (Health and Safety, Chemistry, Geotechnical, and Air). Requirements in this section of the SOW generally should be cross referenced to the other sections relating to the Data Quality Objectives. Additional cross references are noted under the specific activities.

NOT ALL ACTIVITIES listed here are appropriate for every project. The information on quantities is required for the preparation of the Government Estimate and the Contractor's proposal.

The primary consideration during the evaluation and selection of any sampling method should be whether the particular method allows data to be obtained that are representative of the actual environmental conditions. Secondary issues to be considered during the review of potential sampling methods include compatibility with available analytical methods, compatibility with existing site conditions, method reliability, method versatility, logistical considerations, health and safety considerations, and cost.

Intrusive sampling introduces both systematic and random error into the data. Selection of the appropriate sampling method will reduce the introduction of systematic error, while establishment of and strict adherence to quality assurance and quality control criteria will reduce the introduction of random error. Typically, the uncertainty introduced as a result of the means and methods used to collect the sample exceeds the uncertainty introduced as a result of sample analysis. Therefore, care should be taken to consider only those sampling methods that will yield the most representative data set for the site.

Location of sampling is a critical factor in determining the representativeness of the data. Four basic approaches are generally used to determine the physical location of samples collected from environmental media, which are:

- Haphazard sampling
- Judgmental sampling
- Statistical sampling
- Geostatistical sampling.

Haphazard sampling entails the collection of samples at locations convenient to the sample collector, and the objectives developed for the project can be met by obtaining data from most any location at the site.

Judgmental sampling approaches uses technical expertise to determine the most appropriate sampling location, based on operational history, visual survey, and previous sampling.

There are three approaches which can be used in determining appropriate sample locations for statistically based sampling. These are simple random sampling, stratified random

sampling and systematic random sampling. Each method has an uncertainty or error associated with it. Uncertainty or error can be reduced by increased sampling effort, but this increases cost.

Geostatistical sampling design takes advantage of available knowledge of the spatial variability of the parameter of interest to estimate the optimum spacing distance between sample, and the optimal geometry of the sampling grid.

When selecting the most appropriate method to determine sampling locations and the number of samples to be collected from a specific sample media, the following should be considered: the acceptable error as previously identified, the cost available for sampling, and the time required for sample collection and analysis. Additionally, background sampling requirements should account for natural variability of certain parameters.

The number of samples is dependent upon the use of the data to complete the engineering and scientific evaluations specified as data needs. Evaluation of numbers of samples may be based either on expert judgment or statistical analysis. This determination should be coordinated with the project hydrogeologist and a statistician. The statistical basis for the number of samples required is dependent upon the acceptable uncertainty and the selected level of confidence in the data. As described previously, the level of uncertainty is determined by the random and systematic error associated with the data. The selected level of confidence refers to the likelihood that measured value will fall within a specified range from the average value. The level of confidence obtained is a function of the number of samples collected. Equations used to determine the statistically based minimum number of samples required are included in the USACE project planning guidance.

Critical samples are those samples which must be taken in order to fill a data need or a particular objective. These may be, for example, samples collected to prove compliance with a regulatory action level or collected to allow a statistical assessment of the extent of contamination or to provide background or upgradient information. Particular care must be taken to identify critical samples during the design and implementation of the data collection program to ensure that critical samples are obtained in the manner prescribed within the workplans. This includes (1) assuring the sample is representative of the medium of interest, (2) assuring the sample is taken in a manner which maintains the integrity of

the sample and any analytes of interest, and (3) assuring the results are within the prescribed limits of uncertainty for the designated critical samples to allow the project objectives to be attained.

The rationale for the selection of a specific sampling scheme should be discussed for each environmental media or data group defined in the SOW by the responsible project planning team member. By presenting data collection design requirements for at least some of the locations, the Corps reduces the probable number of technical comments on the Contractor's workplan or proposal, because the Contractor will already know what quality, at a minimum, the Corps expects.

If the project contains more than one site, each of the sites should be addressed separately in this section. This encourages the Contractor to develop a proposal based on site-by-site work which allows the customer to see what each site is costing and adjust priorities accordingly. A "project" is defined as the total work to be addressed in the SOW. A "site" is defined here as a geographic study area that is distinct from others based on site history, contamination, or regulatory definition (e.g. solid waste management unit).

Note: The performance of these activities will require considerable coordination between the Corps, the land owner/installation, and local utilities, as discussed in the technical requirements of the SOW. Depending on the nature of the involvement of the regulators (as specified in a Federal Facility Agreement), these requirements may need to be coordinated with them as well. The responsibility for coordination to be accepted by the Contractor must be clearly spelled out under the Project Management Section. Specific coordination requirements are discussed under the individual activities.
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2.3.1 Site Topographic and Boundary Surveys

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This section should describe the surveying required to support the field work, including only the type of survey and area to be surveyed. Refer to the detailed requirements under Surveying in Section 6.1.11 of this SOW. This section would be developed with input from the project manager and surveyor. Coordination may be required with the installation, landowner, or EPA, as appropriate, to see if

any of the topographic data is currently available. May also consider contacting the state and U.S. Geological Survey for any available existing data. This section should also identify the need to determine property lines and owners. There should be a cross reference to the Project Management Section. That section should discuss what existing survey data will be furnished by the Government, if it is available, as well as describe current and planned access rights.
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2.3.2 Geophysical Surveys

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This section describes the required surface or downhole geophysics to be performed. Primarily, this section should describe the rationale of any geophysical work, in how it meets specific data needs. This section could present the areas/locations to be surveyed; the type(s) of geophysical survey instruments, if known, and the spacing of survey lines, the length of lines or depth of the logs. This section should be developed by the hydrogeologist and/or a geophysicist. Flexibility is recommended in the SOW. Allow the Contractor some input based on his/her experience and capability. The Contractor should be required to propose details in the appropriate plan.
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2.3.3 Soil Gas Sampling

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This section should describe the number, depth, and locations of the soil gas samples as well as the rationale of the sampling. The section should also generally define the chemical analyses required for the soil gas samples. Th scope should provide for some flexibility based on the Contractor's capability and experience. This section should be developed by the chemist and hydrogeologist, with specification of data needs by data users.
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2.3.4 Drum/Tank Sampling

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This section should describe the number of samples to be taken, the locations of the tanks/drums, and means for selecting drums for sampling this data group. It should also describe the appropriate chemical analyses (both lab and field). This should be prepared with input from the data users, and data implementors, the chemists. Because of the

safety hazards inherent in drum sampling, input should be provided with regard to health and safety and compliance requirements. The section should reference the Health and Safety Requirements (section 4.). A site visit to observe the drums prior to scoping this activity would be very useful. The scope should describe the historical contents, tank construction materials, and any other data useful to the Contractor.
****

2.3.5 Surface Soil Sampling

****
This section should define the number and locations of the surface soil samples as well as rationale, and required analyses, using the methodology or criteria defined generally in Section 2.3, and the USACE Project Planning guidance document. Any required compositing should be described. If very discrete samples are to be taken, the depth of the samples should also be specified. This section should be prepared with input from the data users such as the risk assessor, design engineer, and industrial hygienist, as well as data implementors such as the chemist, and hydrogeologist. If known, any surface obstructions to sampling should be noted. Sampling of background conditions is strongly recommended whenever sampling soil.
****

2.3.6 Surface Water/Lagoon Sampling

****
This section should specify the rationale for and the number, locations, and depth of surface water or sediment sampling, as well as the required analyses in meeting specific data needs and project objectives. Requirements for sampling water and sediment in sewer systems may be appropriate and would be best quantified here. The flow conditions under which samples are to be taken from surface water or sewers, if applicable, should be described. Any compositing or field screening should also be described. The data users will define the data needed, and the data implementors will advise on the methods to attain data, such as the chemist, industrial hygienist, hydrologist, aquatic biology expert, and process engineer may also be appropriate, such as methodology for sampling a stream, river, waste lagoon or pond. Additionally, project team should seek advise from site decision makers and data users including ecological regulatory experts, for criteria and analyses requirements, so that sampling supports decisions required. Activities may

require coordination with owner or installation if activities are on-going at the lagoon or if there are regulated discharges to the stream/pond. May want to require the Contractor to investigate these outside impacts during preparation of the workplans. Sampling of background/upstream conditions is strongly recommended.
****

2.3.7 Leachate Sampling

****
This section should specify the rationale, number and locations of leachate sampling, as well as the required analyses. The weather conditions and flow rates under which samples are to be taken, if applicable, should be described. Any compositing or field screening may also be described here. Input should be sought from the data user and the data implementors, the chemist and hydrogeologist; however, if sampling around an impoundment or landfill, input or data needs should be identified by a geotechnical engineer as appropriate.
****

2.3.8 Subsurface Soil Sampling

****
This section should specify the rationale for number, locations, and depth of soil borings drilled to obtain chemical and geotechnical information and samples. The quantity can be specified based on total drilled footage, average depth, or specified depths for each hole. This drilling can be combined with well installation under the monitoring well or aquifer testing activities, but the writer must check that the drilling is not specified again under those sections by carefully cross referencing. Any geotechnical testing or sampling should be described. Analytical requirements, both chemical and geotechnical must be stated. Sampling of background conditions is strongly recommended whenever sampling soils.

Input should be sought from the data users, the risk assessor and the industrial hygienist, and geotechnical engineer, as well data implementors such hydrogeologist and chemist, to determine placement, depth, and sampling requirements. Note any site access problems that may affect the use of a drill rig or note any surface obstructions which may affect the use of a hand/power auger. Coordinate with the installation or land owner to identify any unusual conflicts with utilities.

The writer should be aware that the Contractor typically has the responsibility to coordinate and obtain utility clearances but not access rights.
****

2.3.8.1 Soil Borings

2.3.8.1.1 Geotechnical Analyses

****
This section should describe the frequency or depth of geotechnical sampling and the types of lab analyses to be performed as well as the rationale. This input normally is provided by the data user; the design geotechnical engineer or, on occasion, by the hydrogeologist.
****

2.3.8.1.2 Chemical Analyses

2.3.8.2 Test Pits

****
As suggested previously, provide general criteria suggesting why this method of sampling should be used over conventional sampling methods, and how it may be used to support data needs and the site decision.
This section should specify the rationale for and the number, locations, and length/depth of test pits excavated to obtain chemical and geotechnical information and samples. The quantity can be specified based on acceptable uncertainty, for evaluating total excavated volume or footage, average depth, or specified depths for each pit. On occasion, if the pits are excavated to the water table, the work can be combined with well installation under the monitoring well or aquifer testing activities. Again, assure the work is not specified again under those sections by carefully cross referencing. Any geotechnical testing or sampling should be described. Analytical requirements, both chemical and geotechnical must be stated.

Input should be sought from data users, industrial hygienist, and geotechnical engineer and data implementors such as the hydrogeologist and chemist. Note any site access problems that may eliminate possible effective use of a backhoe or excavator. Note any subsurface obstructions which may affect the choice of the excavator. Coordinate with the installation or landowner to identify any unusual conflicts with utilities. Note that the Contractor typically has the responsibility to coordinate and obtain utility clearances but not access rights.
****

2.3.8.2.1 Sidewall/Bucket Sampling

****
Specify where the sampling is to be performed. In some cases, sidewall sampling by personnel who enter the trench may be appropriate, but in other cases, sampling from the backhoe bucket may be adequate. Input should be sought from the data user, such as the risk assessor, and the industrial hygienist, and the data implementors including the chemist and hydrogeologist.
****

2.3.8.2.2 Chemical Analyses
2.3.8.2.3 Geotechnical Samples

****
See discussion under the Subsurface Soil Sampling Section.

****

2.3.9 Fracture Trace Analyses

****
This section requires a study of air photos or even satellite imagery for possible fracture-fault-joint orientation and frequency. These features can affect the flow of ground water and thus this study may suggest well placement. This section should only define the area to be studied and, if appropriate, should discuss the available imagery to be used. This section may also require the field measurement of strike and dip of fractures, joints, faults, foliations, etc. to verify features identified on the imagery. This section would be developed by the data user and data implementor, which in this case would be the hydrogeologist. This work would be done early in the study and may require its own submittal prior to submittal of the overall workplans. Coordination may be required with military agencies, Department of Agriculture, and EPA, to obtain air photos of past or current sites.
****

2.3.10 Monitoring Well Installation and Sampling

****
This section describes the rationale for and the number, location, and depth of wells to be installed at the site. It also requires the frequency of well sampling and water level measurement and the performance of single well aquifer testing. Finally, it specifies the analytical tests to be

performed on the ground water samples. It can also specify number, location, and depth of soil samples to be taken for chemical and geotechnical analyses, if the drilling is not already covered under 6.3 Subsurface Soil/Rock Sampling. Note this section should be carefully cross-referenced with the Subsurface Soil/Rock Sampling Section (6.3) to avoid duplication of work. This work should be cross referenced with the Fracture Trace Analysis Section since, in some cases, the well locations will be proposed based on the results of the analysis.

This section is developed based on close coordination between the data users, such as the risk assessor and designer, and the data implementors such as the hydrogeologist and chemist. Additionally, project team should seek advise from decision makers including regulatory agencies for criteria and analyses requirements, so that appropriate data needs may be specified which support site decisions. Coordination may also be required with the state regulators, if the well installation requires permits. This responsibility is normally assigned to the Contractor but not access rights.
****

2.3.11 Air Sampling

****

This section should describe the rationale and requirements for sampling the air at the site. Air sampling during field investigations may have various purposes. Among these are determination of background concentrations of airborne contaminants at undisturbed sites and determination of emission rates from various remedial activities and alternatives. After considering data needs and uses, this section should include requirements for sample locations (i.e., source, perimeter, receptor, etc.), numbers, frequency, duration, and analytical parameters. Any special instructions specific to the site, such as the time of sampling relative to weather and wind conditions, site operation schedule, etc. should be discussed. This section should not be used to define air monitoring requirements for worker safety and health as those are addressed in the SSHP. Requirements for meteorological monitoring, if any, should also be described here.

This section should be developed by the chemist, the industrial hygienist, the risk assessor, process engineer, and possibly a meteorologist. It should be carefully cross referenced with the analytical procedures in section 2.4 as

well as additional requirements in the chemistry and air sections (5 and 7) to avoid duplication.
****

2.3.12 Wipe Samples

****
The number of wipe samples and locations or general surfaces to be wiped should be defined here. The analysis of the wipe samples should be specified. This section should be developed based on input from the risk assessor, and industrial hygienist, with the coordination of the chemist.
****

2.3.13 Infiltration Testing

****
The number and locations (optional) of infiltration tests should be specified. This section should be developed based on data needs identified by the hydrogeologist, the geotechnical engineer, and other personnel involved in the review of the risk assessment (since infiltration rates may affect the risk assessment).
****

2.3.14 Vadose Zone Permeability Testing

****
This section would describe the number of unsaturated soil in-situ air permeability tests and prescribe certain locations as well as the rationale for sampling. There is a broad range of tests to this end which require different levels of effort. If the type of test varies from site to site, the type of test should be defined. This section could be developed by the hydrogeologist, but engineers familiar with soil vapor extraction should have input. This section should be cross referenced with the data needs defined in the section on treatability studies (2.9) since the data gathered may affect or overlap the results of certain treatability studies. It should also be cross referenced with the section on air sampling, if the air quality impacts of the test are of interest, and fate and transport sections if modeling is required.
****

2.3.15 Tracer Studies

****
This section should define the number, locations, and rationale of any tracer tests to be performed. The purpose of these tests should be carefully described, and may include development of dispersivity values, verification of ground water flow path and rate, or investigation of potentially leaking utilities. If chemical analyses are required as part of monitoring the tests, these should be coordinated with the chemist and cross referenced to the Analytical Procedures Section (2.4.2). If the tracer tests use soil gas measurements as a monitoring process, then this section should cross reference to the Soil Gas Section (2.4.2.7).
****

2.3.16 Aquifer Tests

****
This section should define the number, locations and rationale of multi-well aquifer tests to be performed at the site, as well as the number, frequency, and analyses of chemical samples of the discharged water over the course of the tests. Because of the frequency and number of samples to be analyzed in some cases, it may be appropriate to specify the establishment of an on-site lab in this section. This would require careful cross-referencing with the section on Sample Analyses, Data Assessment and Reporting (2.4) to clarify the numbers of samples for on-site versus fixed lab analyses as well as the appropriate QA/QC. The majority of this section would be prepared by the hydrogeologist with in put from the data users; however, close coordination between the chemist and hydrogeologist may be necessary depending on the level of effort in sampling. As discussed under Geotechnical Requirements (Section 6), this activity may require coordination with the installation, a local treatment plant, or the regulators, depending on the mode of pump test water discharge, and the importance of the impact of other nearby activities, such as production well use. Note again that this activity can generate large volumes of possibly contaminated water that must be treated and/or disposed of.
****

2.3.17 Imminent Threats to Human Health or the Environment

****
This section should state that if the Contractor, during performance of field work, notes conditions at the site that pose an imminent threat to public health or the environment, the Contractor is instructed to immediately take initial re-

sponse actions and bring the situation to the attention of the Contracting Officer. USACE will be responsible for contacting EPA, state, and local authorities.
****

2.4 Task 4 Sample Analyses, Data Assessment/Validation and Reporting

****
The Sample Analyses, Data Assessment/Validation and Reporting Section of the SOW should include as much site-specific information as is possible. It is important for the Contractor to obtain adequate guidance as to what is expected in all phases of the project. As with information outlined in all tasks of the SOW, an interdisciplinary approach is necessary for a cohesive contract document to be generated. The project chemist must collaborate with the data users in formulating the appropriate analytical requirements to meet data quality objectives, based on acceptable uncertainty associated with sampling, and project constraints, for the data collection design.

The selection of the appropriate analytical method is critical to generation of a data set that will meet data needs to support site decisions. Data that is representative of both the type of contaminant and the contaminant levels in the sample to meet data needs should be evaluated. The following factors should be considered by the team during their review and section of methods to analyze samples collected at the site:

- -contaminants of interest
- -sample media
- -likely range of contaminant concentration
- -analytical turnaround time
- -identification or quantification or both required
- -required quantitation limit
- -cost

Quantitative analysis also introduces both systematic and random error into the data. Selection of the appropriate analytical method will reduce the introduction of systematic error, while establishment of and strict adherence to QA/QC criteria will reduce the amount of random error introduced. The team should consult USACE project planning guidance in choosing the appropriate analytical methods. The guidance includes each method's possible use and applicable precision and accuracy performance criteria.

The type of samples collected can be discrete or composite samples, dependent on the intent of the data and representativeness of the medium sampled. Composite sampling can result in the non-detection (false negative) of low concentration of analytes or compounds, due to dilution factors introduced.

Precision, accuracy, representativeness, completeness, and comparability (PARCC), are used to measure the quality of data obtained from sampling. The level of precision, or random error associated with a given set of measurements, calculated using standard deviation or relative percent difference in replicate analysis, is determined by the objectives of the project. Precision is commonly controlled by taking a sufficient number of samples, including replicates.

Accuracy is the estimate of the relative agreement of the measured value with true or expected value. Accuracy is controlled by prescribing appropriate sampling procedures, sample handling (including preservation) and analytical procedures. In addition, strict adherence to standard operating procedures during sampling and analysis, and avoiding field cross-contamination by implementation of thorough decontamination procedures.

Representativeness is the degree to which data accurately and precisely portrays the environmental condition being studied.

Completeness is the estimate of the number of valid measurements made as compared to the total number of measurements performed. The level of completeness required for a given set of data is determined by the number of valid measurements that must be obtained to satisfy the data use.

Comparability is the qualitative estimate of the relative confidence with which the data obtained from one set of measurements may be compared to data from another set of measurements. The degree of comparability is directly related to the precision, accuracy, and representativeness of the data in each set. The team should evaluate these factors that are likely to contribute to systematic and random error of the data and select appropriate methods that allow collection of the type, quality, and quantity of data need to support site decisions.

Once the specific data collection program is selected, the chemist should assist in defining the implementation requirements, for data collection and analysis for incorporation within the workplan attachments (CDAP). Additional informa-

tion on implementation requirements are provided in greater detail in Enclosure 13 to the ETL.

The Contractor represents an expert source of information in HTRW investigations and should develop an interactive communication with the USACE project team during negotiations and through execution of the RI/FS. The USACE project team must decide what level of flexibility the Contractor will have with respect to each aspect of the project. If a multi-site RI/FS is being developed, each site should be addressed separately within this section with individual tables prepared outlining sample types and quantities, corresponding analytical specifications which were devised from the data collection design analysis, and associated statistical variables. An example and suggested format for these tables are located within the project planning guidance (Completed Data Collection Option Array). Additional frequency tables may be prepared outlining a summary of field samples and field generated QA/QC sample numbers for the individual sites and / or the project as a whole. This serves a dual purpose of clarifying what is required of the Contractor at each site, and making negotiations more manageable. Quite often, the customer will also require project cost breakdown on a site-by-site basis.

General chemistry workplan attachment (CDAP) requirements are outlined in the technical requirements section (5) to this SOW. A detailed discussion of the implementation requirements is located within Enclosure 13 to the ETL. Work specified in this section of the SOW must be appropriately addressed in subsequent Contractor submittals. The review of submittals to assure project goals are being met is a duty of the USACE project team.
****

2.4.1 Data Review and Assessment/Validation

****
This section should specify functional guidelines for data review and assessment/validation for determining new data collection requirements which the Contractor is responsible to perform. A detailed explanation of Data Evaluation as opposed to Data Assessment/Validation requirements for evaluation of data are included in Task 5 Section 2.5, "Data Evaluation/Fate and Transport". The following specifications for data assessment/validation is as it applies to new data collection design considerations.

The chemist, based on project-specific data needs defined by data users, should develop and describe within the SOW the acceptable PARCC parameters for data assessment, as it applies to new data collection design considerations. These criteria should be defined based on data user requirements. The project designer, regulatory compliance specialist, and risk assessor should define the data needs to be addressed by data collection design specifications in this section. The chemist may collaborate with the data users to ensure data needs established are complete. Input on other potential contaminants based upon operations and disposal practices, contaminant breakdown products, and/or contaminant physical characteristics which may effect mobility may be suggested when defining the overall data needs.
****

2.4.1.1 Existing Analytical Data

****
Existing data review and assessment/validation are critical interdisciplinary areas within the SOW. When developing requirements for data to be collected for a project, the data needs must be reviewed relative to existing data, in determining whether data may be reused and/or supplemented if appropriate, when specifying Contractor requirements to generate new data. The USACE project team should compile available data to help make determinations of usability of existing data relative to identified data needs, avoiding a duplication of effort, minimizing costs, and time associated with collection of data. This information should be summarized in section 1. of the scope.

The project chemist, risk assessor, hydrogeologist, and process engineer jointly review past data, given the intended level of confidence required, quality expected, in verifying whether it meets DQOs, subsequently identifying any data gaps, in defining additional data required. The project team can then specify additional data needs with the most efficient utilization of resources.

The Contractor is required in this section to summarize this review and evaluation within the project workplan, attachments, and subsequent reports. In some cases, the Contractor may be tasked to conduct the data evaluation initially in the project workplan, for review and approval of the project planning team, in devising new data collection requirements. For either case, whether USACE project planning team, or Contractor conduct the data evaluation of existing data, in most

situations, the Contractor is tasked to thoroughly search for and review existing site data.

Existing analytical data will be reviewed for it's usability based upon the project DQOs. In the event sufficient information does not accompany the background data for this assessment, it may be used qualitatively to identify contaminants of concern, narrow or expand future analytical protocols, or direct sample acquisition. This section should include project requirements for acceptable existing analytical data. Define PARCC parameters for each end-use of data (see tasks 5, 6, 7, and 8). Instructions should be cross-referenced from Sections 2.1, and Section 2.4.1 and Section 2.5. Task the Contractor to submit details on required data review to be conducted on existing analytical data in the Project Workplan, with implementation requirements specified in the CDAP attachment.

Background data may be obtained from EPA technical and enforcement files, state/local regulatory agency files, U.S. Geological Survey files, government installations, and other relevant sources in order to describe the current situation at the site(s). Preliminary data collected should be confirmed by on-site observations. A site walkover clarifies current site conditions compared to conditions during previous investigations. Often sites are manipulated or altered subsequent to studies. Quality of data should be analyzed to determine its usability. Some factors to consider in addition to project specific DQOs, when reviewing the quality of data includes: age of the data, procedures and documentation.

The uncertainty associated with available data and whether proposed project activities will supplement this data should be specified in the SOW, for workplan preparation and report generation, defined by Data Quality Objectives, and specific data needs.
****

2.4.1.2 New Data

****
This section should define guidelines for the appropriate analytical levels to be used for data collection design for new data collected during the project and corresponding PARCC parameters which will indicate acceptable data quality based upon the identified data needs. Data users will define data needs for each site with considerations for tasks #6, 7, and 8. The Contractor is tasked to propose data review and

assessment/validation details in the Project Workplan, with implementation requirements included in the CDAP.

Once the project technical staff has determined general site strategy, project objectives, acceptable uncertainty and data needs as identified by the data users, the chemist should specify the analytical method design requirements. Each of the following factors shall be considered in designating each analytical parameter: (1) Levels of acceptable precision, accuracy, representativeness, completeness, and comparability (PARCC parameters), (2) required quantitation limits/sensitivity, (3) determine completeness requirements for identified critical data, (4) data assessment / validation requirements, and (5) the format for data presentation. In some cases, the precision and accuracy criteria published within the analytical methods may be sufficient for the data need and should be referenced for each analytical method specified, rather than stated in their entirety. Specify the applicable quality control tables from within the methods for criteria to be maintained during sample analysis. For methods which do not publish quality control criteria or if more stringent criteria than what is published is desired, the chemist should specify the criteria to be maintained individually. Guidance on this subject may be obtained from the USACE project planning guidance, as well as referenced directly from SW-846 chapter one, and Contract Laboratory Program (CLP). Data users will help define specific features of data needs including allowable quantitation limits, and quality of data required, and the chemist should verify the specified methods which are applicable and are able to confidently achieve quantitation limits below the contaminant levels. The SOW should state which qualifiers on data (i.e. PARCC parameters) can invalidate the use of certain data, (see section on Data Usability under task 5).
****

2.4.2 Analytical Procedures

****
The following sections of the SOW will outline specific analytical protocols to be followed on a site-specific basis for each data group. Tables should also be generated by the chemist to summarize this information. The Contractor will summarize each of these subsections in the CDAP attachment to the workplan.

Before developing this section of the SOW, the chemist should be provided information from the data users, for data needed such as what contaminant he/she wants to detect (i.e. metals,

PCBs, volatiles), acceptable uncertainty, what detection limits are needed (%, ppm, ppb), and what matrix type, data group, will be sampled on a site by site basis for the entire RI/FS. Factors to be considered in selecting an analytical method for a specific data need include specificity, sensitivity, variability, accuracy, analytical measurement error, cost, necessary equipment, time, skill level, QC, and required documentation.

The Chemist should specify analytical procedures as needed and cite the appropriate references and methods required. The chemist should also specify whether field screening techniques or mobile laboratories/on-site analyses will be used. This section specifically identifies the criteria for each analyses on a site and matrix-specific, data group basis. Actual numbers of samples specified for each sampling location are discussed under Task 3 Field Investigations. The project chemist should generate tables summarizing information stated in this section of the SOW. An example and suggested format for these tables are located within the project planning guidance (Completed Data Collection Option Array).

The rationale for SOW instructions on analytical procedures must be included in this section. The project planning methodology used in constructing DQOs, is critical in determining fact in any text describing rationale. The Contractor will be required to reiterate DQOs in subsequent deliverables, when describing analytical methods chosen, evaluating data collected, expected quality, acceptable uncertainty, confidence required, and sampling collection and analysis protocols.

The chemist should add detail to other applicable sections of this task related to each analytical procedure. The Contractor is responsible for reviewing and adding input in this section of the SOW thereby assuring the goals of the RI/FS will be met. The chemist and project technical staff must carefully review Contractor suggestions based upon professional judgement.
****

2.4.2.1 Field Screening

****
This section should define field screening methods to be used in support of sample design, for the RI/FS. The chemist and geologist should propose acceptable methods to the Contractor. A Contractor may also be given latitude to propose

field screening applications. The Contractor must summarize all field screening in the CDAP for review and approval. Care should be taken to confirm the acceptability of the proposed screening methods with regulatory interests.

Field screening is primarily used to provide indications of contamination at analytical levels I and II. Decisions based on these results are usually qualitative in many circumstances. Results of field screening are usually used to design judgmental soil sampling options in focusing on specific areas of contamination or "hot spots", to screen samples for chemical analysis requirements, or as a source of additional sample monitoring information.

Proper field screening techniques can be instrumental in reducing the time it takes to perform an RI/FS, reduce costs, reduce "intrusive" sampling locations, and, in general, lead to more effective use of level III and IV analyses. Field methods and field test kit examples are as follows: soil gas, organic screening (HNU,, OVA), metals screening (geophysical, X-ray fluorescence), PCB/PCP test kits.
****

2.4.2.2 Water

****
The chemist should consult with the project technical staff and specific data users to develop an appropriate analytical protocol as it pertains to water matrices in order to meet the project objectives as established by the data users. Reference previous sections in this ETL over Project Planning Overview and Objectives and the USACE project planning guidance for input on formulating project objectives. Once the objectives are established, the chemist consults with the data users to formulate the most appropriate analytical protocol to fulfill the data needs. Water analyses often deal with trace levels, therefore it is critical that data needs of the data quality objectives associated with various water analyses be clearly stated in the SOW.

Data needs to meet compliance requirements should be evaluated closely. There are more ARARs for groundwater and surface water than any other environmental matrix. Additionally, data needs to support risk assessment, evaluated relative to toxicity reference concentrations, those levels applicable for effective evaluation of risk, should be considered when selecting analytical methods.

Water quality parameters, such as total dissolved solids,

chloride, sulfates, and carbonates may also be identified as a data need for specific design considerations, and toxicity evaluation, and fate and transport. These parameters are important in defining water resource quality and subsequent risk analysis and regulatory requirements. Later treatability studies data needs for water samples may also require the chemist to include water quality criteria evaluation during the RI/FS process. The chemist should consult with' a process engineer.

The chemist should be aware that the results of the metals analyses of filtered versus unfiltered water samples often come under scrutiny. Specific data needs in this regard should be identified by the data users; however, it is often advisable to run a percentage of samples for both filtered and unfiltered metals samples in order to eliminate inadequate results later during data interpretation. Consult with the risk specialist, regulatory specialist, and designer before settling on a program of metals evaluation in groundwater samples.

Data needs for chemicals/products resulting from degradation/removal mechanisms such as biodegradation, photolysis, chemical reactions, and radioactive decay may have to be considered in analytical method selection and sampling requirements.

The chemist should also be aware that testing of drilling or other source water may be necessary. Consult with the geologist and reference Section 6.1.8 to determine whether water will be used during drilling operations.
****

2.4.2.2.1 Surface Water Samples
2.4.2.2.2 Ground Water Samples
2.4.2.3 Soils/Sediments/Sludges

****
The chemist should be supplied with information regarding the specific data need, after consulting with the project technical staff and specific data users to develop an appropriate analytical protocol as it pertains to soil, sediment and sludge matrices. Background sample analysis is critical to every RI/FS, the data user and the chemist should make certain these samples are collected and analyzed on a site-specific basis. In some instances, an installation-specific collection of background soil samples may be appropriate. Decision makers, regulators must be

consulted for each installation to determine the most appropriate approach.

Data needs for chemicals/products resulting from degradation/removal mechanisms such as biodegradation, photolysis, chemical reactions, and radioactive decay may have to be considered in analytical method selection and sampling requirements.
****

2.4.2.4 Drum Samples

****
Analytical protocols for drums must be based on data needs defined by regulatory specialists, and designers from background accounts of suspected contents, for disposition, and applicable regulatory compliance specifications. Past records or information should prove useful, and should be reviewed by the project team in defining data needs. Based on remediation/design data needs, if the waste is to be moved off-site, RCRA characterization should be performed. Used oil, or PCB-containing waste may require other analytical approaches. The projected design or remediation data needs for the drummed contents should be identified for the chemist to develop the analytical approach. Compatibility testing may be chosen based upon bulking options. Field screening with supplemental off-site laboratory disposal analyses are two considerations for implementing the analytical program for drums.

Data needs defined by the project regulatory expert should be obtained to assist the chemist in decisions regarding drum analytical protocols. The analytical test to be run may fully depend on the design needs or ultimate fate of the waste. The Contractor should be given liberal input in this aspect of the RI/FS.
****

2.4.2.5 Wipe Samples

****
Wipe sampling is often incorporated in project specifications to determine if buildings, containers, or structures are contaminated prior to demolition/removal. If this is appropriate for the project, data users should review the past history of the site to determine data needs and the chemical parameters of interest. The risk assessor and industrial hygienist should be consulted as to data needs

such as potential analytical concerns and probable sample numbers necessary to characterize contamination in each specific application. The Contractor typically proposes, pending review and approval, the specific procedure to collect and analyze each wipe sample.

The data users should be aware that wipe sampling action levels exist for PCBs. However, it may not be clear what solvent / liquid media type is appropriate for various wipe-sampling schemes. This is dependent on the individual wipe samples' required analysis. The data users should rely on the chemist and appropriate laboratory personnel to decide the appropriate liquid media to be used with that wipe. It is necessary to supply the laboratory with individual wipes for each analytical parameter to be run, as well as, sending a blank wipe sample for each parameter to allow quantification of any interferences from the filter (or gauze) or the liquid media used.
****

2.4.2.6 Air Samples

****
This section should describe the rationale and requirements for use of specific analytical methods for air. As stated in section 2.3.11, air sampling during field investigations may have various purposes. Among these are determination of background concentrations of airborne contaminants at undisturbed sites and determination of emission rates from various remedial activities and alternatives. Concerns generally focus on gaseous emissions of volatile and semivolatile organics and particulate emissions of semivolatile organics and inorganics. Methods should be chosen after considering data needs and uses. Methods may include both field screening techniques and in-depth laboratory analyses. Since many methods describe requirements for sample collection in addition to analytical procedures, this section should be carefully cross referenced with section 2.3.11 as well as additional methodology requirements in the chemistry and air technical sections (5 and 7).

This section should be prepared by the chemist with input from the industrial hygienist, the risk assessor, process engineer, and possibly an air monitoring expert and meteorologist.

Air monitoring with health and safety applications is defined by the industrial hygienist. The chemist and industrial

hygienist must work closely to assure all air sampling protocols are appropriately detailed in the SOW.
****

2.4.2.7 Soil Gas

****
Soil gas analytical methods may be incorporated into a sampling scheme to determine the presence of volatile organics in the soil pores. Soil gas surveys are typically used to supplement or direct conventional soil and groundwater sampling and analyses data needs. It is not useful quantitatively to solely determine regulatory compliance nor does it serve risk assessment data needs. Reference section 2.3 Field Investigations for details on the effort required for soil gas sampling. The utility of soil gas analytical methods vary depending upon the nature of the contaminant and the environment at a particular site. The chemist and hydrogeologist should collaborate in determining the pros and cons associated with available soil gas options, based on identified resources available, the application to data need, extent of soil gas sampling to occur at the site, and the level of analytical testing best serving the RI/FS process.

Contractors should have significant input in proposing soil gas analytical approaches based on capabilities in-house or which may be subcontracted.

The chemist should be aware that compound-specific analyses are available compared to total analyses. If compound-specific analyses are being performed on-site, the chemist should consider specifying off-site laboratory confirmation at some frequency.
****

2.4.3 Quality Assurance/Quality Control Samples

****
USACE ER 1110-1-263 requires that Field Quality Assurance (QA) and Quality Control (QC) replicate samples be collected and analyzed by the government QA and the contract laboratories, respectively. In addition to the QC replicate mentioned above, other QC samples may include field (equipment) blanks, trip blanks, etc. This section of the SOW must state the QA/QC requirements for the project on site by site basis. The chemist should provide the information in a tabular form. The Contractor must also summarize this information in the CDAP.

When evaluating the levels of QA/QC for an RI/FS, the chemist must clearly keep in mind the project data needs and DQOs. QA/QC varies dramatically depending upon analytical level (I, II, III, IV,or V) of the analysis selected.

As outlined in Enclosure 13, a pre-draft data package will be submitted to the QA laboratory for generation of the Chemical Quality Assurance Report (CQAR). This includes a comparison of the data generated from the Contractor's QC and the USACE QA laboratories and an assessment of the QC maintained during the analyses. In order to complete the CQAR, the QA laboratory reviews the internal quality control and method requirements, providing a preliminary determination on the usability of the data generated during the project. This data package should contain at a minimum all chain of custody and completed cooler receipt forms, and those items outlined within Enclosure 13 to allow the USACE QA laboratory to review PARCC parameters. The timeliness of the USACE generated CQAR will be contingent upon the completeness of the data compilation and the punctual release of this material. For this reason, the project chemist may require the opportunity to review the submittal for completeness and verification that DQOs were met prior to/or concurrent with the release to the Division laboratory.
****

2.4.3.1 QA Laboratory

****
This section should specify which USACE lab will be the QA lab for the project. It should also be stated that the Contractor is responsible to send field-generated QA samples to the specified laboratory. The project chemist should generate frequency tables summarizing exact numbers of QA samples to be sent to the QA lab on a site by site basis. The Contractor should reiterate this in the CDAP.

USACE PM should specify the QA laboratory after contacting CEMRD. The project chemist should check with the QA lab to find if they have special identification/information needs attached to field samples that will be sent to them by the Contractor in the field. The Contractor should also be tasked to identify which field sample they will analyze that corresponds to the USACE QA sample. Insert language in the SOW that the Contractor is responsible to notify the respective USACE QA lab of incoming samples at least 2 days in advance.
****

2.4.3.2 QC Samples

****
This section should contain specifications as to the type and numbers of QC samples to be generated on a site-specific basis. The chemist should generate a table summarizing this information. The chemist should also specify laboratory QC requirements on a method specific basis. The Contractor will summarize this in the CDAP.

QC will vary depending on the analytical procedures chosen to meet data needs and DQOs. The chemist should develop tables summarizing the type and quantity of QC field samples for each site in the RI/FS, and the rationale used in selecting these requirements. Field QC samples may include field replicates / duplicates, field blanks / equipment blanks (rinsates), and trip blanks. QC samples sent from the field to the contract lab should be blindly labeled.
****

2.4.4 Laboratory Internal Quality Control

****
The Contractor laboratory is also responsible to perform internal QA/QC samples per batch for each analytical method specified. The project chemist should include language in the SOW directing the contract laboratory as to their QA/QC requirements. An additional analysis fee may be attached per internal QC sample when specified to be performed on USACE project samples. The project chemist must also ensure that sufficient sample volumes are submitted for analysis in light of the project QA/QC requirements. Acceptance criteria for precision and accuracy of laboratory internal QC is detailed in section 2.4.1.
****

2.4.5 Method Detection Limits

****
This section must contain instructions to the Contractor as to specific method detection limits and/or practical quantitation limit which will be contract requirements for this RI/FS. The risk assessor, designer, and the regulatory specialist should define these criteria for the chemist for each of the analytical methods specified in the previous section. The Contractor must summarize method detection/practical quantitation limits in the CDAP, and the rationale used in selection/specification.

Method detection limits have a direct effect on ability to properly evaluate identification of potential chemical and location-specific ARARs, To Be Considered (TBC) information, design criteria, and risk assessment. Action levels of contaminants of concern should be investigated and summarized in this section. It is critical that the analytical technique chosen has a detection limit below the level of concern. The chemist should also consider that, regardless of the specified method detection limit, the actual practical quantitation limit reported may (and usually is) be sample specific. Samples containing complex matrices and numerous analytes at widely-different concentration ranges may result in raised quantitation limits due to dilution factors. This must be considered by the chemist when selecting analytical options.

It is important to include criteria for detection\quantitation limit requirements in this section, for meeting data quality objectives. Specify minimally, according to each procedure outlined above. It is also necessary that Contractor understands and includes this rationale in the contract submittals.
****

2.4.6 Laboratory Turnaround Time

****
This section should include information from the chemist as to the turnaround time for completed data reports to be generated from the laboratory. This will be stated in the CDAP by the Contractor.

The project chemist should be provided with project information from decision makers and data users regarding scheduling constraints, and budget, in specifying SOW requirements for reporting. The usual turnaround time for reporting data to a customer from a contract laboratory is approximately 45 days. An additional fee is usually attached per sample for expedited turnaround times.
****

2.4.7 Sample Handling

****
In this section of the SOW the chemist must specify sample handling for the RI/FS. Enclosure 13 to the ETL contains chemistry technical requirements for this topic separated by matrix. Special attention and specification within the SOW should be given to non-traditional needs. The Contractor

must summarize all sample handling procedures in the CDAP.

During every phase of site characterization and sampling, consistent procedures and documentation must be performed in order to achieve information that will be used for decisions in the RI/FS process. The chemist must specify in the SOW that the Contractor is responsible for documenting sampling activities and developing SOPs for all sampling methodologies. DQOS specific to the RI/FS must be incorporated in SOW instructions and in Contractor submittals.

Maintaining sample integrity, the chain of custody (COC), and evaluating sampling accuracy are critical factors that must be documented and reviewed before resulting data is considered valid. Verification of sample shipment may be accomplished by requiring the Contractor's QC laboratory to complete a cooler receipt form or equivalent upon receipt and opening of the cooler. The form is then returned with a copy of the COC along with the data report. The project chemist must consult with data users to determine if standard USACE sample handling protocols are adequate for the project or if special applications exist.

Sample handling should also consider sample disposal. Chemist should contact Corps lab to determine how samples will be disposed of after analysis since there is a potential that the samples may, on occasion, be returned to the site for disposal.
****

2.4.8 Preservatives and Holding Times

****
The project chemist must specify preservatives and holding times that will be contractually required during the course of the RI/FS. A table should be prepared for insertion into the SOW clearly outlining each analytical protocol with this information. The Contractor should be made aware that holding times are not to be violated and, should this happen, the Contractor is liable for possible resampling.
****

2.4.9 Investigation-Derived Wastes (IDW)

****
EPA has issued guidance for handling IDW entitled "Management of Investigation-Derived Wastes During Site Inspections", EPA 540/G-91/009, dated May 1991. The chemist should be aware that IDW will be present both at the site and at the

laboratory subsequent to sample analysis. Sampling IDW is addressed in section 2.3. All laboratories conducting analyses must be instructed whether to ship completed samples back to the site, or to handle them appropriately as IDW. There may be a nominal fee involved with the disposal of solid samples by the laboratory. For this reason, the project chemist should require the acquisition of only enough sample volume to conduct the required analysis and associated quality control (QC) according to the analytical method. Waste from an RI/FS site must be considered as "suspected hazardous IDW" until it can be proven otherwise. In addition to standard analyses typically run in an RI/FS, wastes may also be tested for RCRA characteristic waste analyses. The project chemist and Contractor must develop some analytical protocol that will be adequate to determine whether IDW from the subject site may be classified as non-hazardous or a characteristic hazardous waste. The contract laboratory must also be instructed whether to ship completed samples back to the site or to handle them as IDW. The chemist must be aware that the proposed analytical protocol for the site IDW must be appropriate not only to determine if the waste is hazardous, but also must generate enough information for later manifesting and shipping requirements, if necessary.

While this IDW guidance is for CERCLA sites, since the IDW may be a RCRA hazardous waste, it is important to talk with your state RCRA office to gain an understanding of the definitions of wastes and the requirements for disposal of IDW. Some states will allow you to screen the samples and put them back onto the site or bulk them for disposal. Other states will require a full analytical scan to determine if you have a RCRA hazardous waste.

A solid waste is a RCRA characteristic waste if it exhibits the characteristic of ignitability, corrosivity, reactivity, or toxicity (Toxicity Characteristic Leaching Procedure, TCLP, see FR 11796-11877, March 29, 1990). The TCLP has replaced the EP-toxicity test for identifying RCRA characteristic waste. However, a few states still require the EP-toxicity testing done in addition to the required TCLP analysis. As stated earlier, verify with your state RCRA off ice for the requirements of listing and disposal. Any type of IDW that contains listed hazardous wastes should be considered a RCRA hazardous waste.

The project chemist should include instructions in the SOW to the Contractor on how IDW from the subject site is to be managed. The Contractor may also be tasked to propose a waste handling plan (within the text of the CDAP) thereby

proposing how to determine whether wastes from the RI/FS project site are characteristic, listed or non-hazardous. Both the project chemist and the regulatory expert should review the proposed Contractor plan for handling IDW to assure compliance with regulations. The project manager should also consult with the customer and regulators to assure IDW are handled in an acceptable manner during the RI/FS. The project chemist may need to cost out additional tasks during negotiations for chemical testing and handling of IDW (see EPA guidance document 540/G-91/009, Management of Investigation-Derived Waste During Site Inspections). The project chemist and hydro geologist will need to estimate the approximate volumes and types of I.W. that will be generated in the RI/FS process.
Types of I.W.:

-Soil cuttings
-Groundwater from well development or purging
-Personal protective equipment (P.E.)
-Disposable sampling equipment
-Drilling mud or water
-Cleaning/decontamination fluids
-Laboratory I.W.

Cross reference to the Geotechnical Requirements Section regarding activities which may generate I.W..
****

2.5 Task 5 Data Evaluation/Fate and Transport Analysis

2.5.1 Data Evaluation

****
This section describes the requirements for the Contractor to evaluate newly acquired data. The data evaluation step of the report preparation, as defined by the USACE project planning guidance, consists of three steps;

- Assessment/Validation of collected data
- Evaluation of collected data
- Verify Usability and DQO Attainment

The first two steps enables us to determine if the data obtained are reliable and generally acceptable for use on the project. The last step is designed to determine if the maximum levels of specified uncertainty used in designing the data collection program were attained.

The Contractor will be responsible for reviewing and evaluating *I* validating data resulting from the investigation, in accordance with the specified requirements. The

presentation of data is to be both tabular and discussed in text form. The data text presentations should clearly define whether DQOs were met, and to what degree they were met. The level of detail put into this section of the SOW will help define what data evaluation tasks are contractually required for this particular RI/FS. Data must be reviewed relative to original data quality objectives, in addressing the data needs. What may be acceptable to be used to address data needs in a treatability study may not be acceptable in a risk assessment. Additionally, the final acceptability of data quality is not established until the reviewed QA/QC package accompanies the analytical data.
****

2.5.1.1 Comparison to Data Quality Objectives - Establish Data Usability

****
This section would require that the original data quality objectives defined by the project planning team and further refined by the Contractor in the workplan be reiterated in the Data Evaluation Section of the RI Report, to provide a comparative basis of data usability for new data collected, and reiteration of workplan evaluation of existing data. Original objectives including specifications for defining acceptable uncertainty, documentation requirements, analytical detection limits, data quality and quantity requirements, precision, accuracy, completeness, comparability, and representativeness are evaluated against the data collected, to determine whether data may be used for the originally intended purpose. More specific usability parameters such as geotechnical and or hydrogeological characteristics are evaluated also to support the intended uses of the data including risk assessment, feasibility study, and design. This section should be prepared by the project team.
****

2.5.1.1.1 Refinement of Site Conceptual Model

****
Conceptual Site Models, such as what may have been initially specified by the project team in Section 1.0 of the SOW, are schematic representations, rather than figures, to show interrelationship of data need elements needed to serve project decision needs, such as risk, liability, feasibility, and compliance.

As part of data evaluation, the Contractor will be required to assemble all new data of acceptable quality into previously defined data need categories, and apply this information in refining the Workplan Conceptual Site Models. This will aid in organizing the evaluation, in allowing a preliminary determination of whether general data needs have been met, and data quality objectives have been achieved for the project. The section should require the Contractor to reevaluate model elements, to determine generally for data need categories whether data collected fulfills data needs to be used to: 1) evaluate risk to human health and the environment, 2) assess feasibility of remedial alternatives and design requirements, 3) determine regulatory compliance, and 4) define liability and cost recovery considerations, as specified by original data quality objectives.
****

2.5.1.1.2 Hydrogeology

****
This section should require the Contractor to analyze the new data to refine the understanding of the hydrogeology of the site as it relates to specific data needs and data quality objectives. Hydrogeology data is used in evaluating migration pathways for the site contaminants for the risk assessment, for remedial design, for compliance purposes, and in clarifying liability issues. This analysis would include, for example, the interpretation of geologic environments of deposition, the heterogeneity of the site stratigraphy, the characteristics of the site soils/rock which may affect contaminant transport (thickness, permeability, organic carbon content), and the ground water flow direction and rate. This would include the production of cross sections, maps, histograms or other presentations of the data. This information would be presented in the RI/FS report and will be used in the fate and transport as well as alternative analysis. This section should be prepared by the hydro geologist.
****

2.5.1.2 Nature and Extent of Contamination

****
This section should describe the requirements for refining knowledge of the volume of sources areas or the nature and extent of contamination at the sites, as it relates to specific data needs. Design needs may include quantitation of specific volumes of contaminated media for evaluation of

feasibility of remedial alternatives, and risk assessment may require quantitation of exposure to populations from specific portions of site media. The Contractor should be required to address each data need in providing the degree of quantitation required for each effected media, and in organizing and presenting the information, pertinent to the intended use of the data.

This section can be written by the any of the project team members, but should be reviewed by the chemist, hydro geologist, and the data users. This section may require the Contractor to prepare drawings illustrating the extent in map view or cross section, and tables of contaminants identified at the site. The Contractor should be encouraged to use computer-generated graphics and tables to reduce cost and improve quality by reducing editing effort and assuring consistency. The Contractor should segregate discussions for each media/area as dictated by data needs. These items are to be developed as part of the RI report and do not require a separate submittal. Careful cross referencing to the RI Report Section (2.7) would be helpful in avoiding a duplication of instruction on preparing these items and double payment for the work.
****

2.5.2 Fate and Transport Analysis

****
This section should require the analysis of the potential for transport of contaminants by all affected transport pathways; ground water, surface water, air, as originally defined by the conceptual site models, to meet specific data needs.

In addition to applicable transport mechanisms, transformation and/or attenuation mechanisms should also be evaluated for the effected media. In some cases quantitative analysis of chemicals/products resulting from degradation/removal mechanisms such as biodegradation, photolysis, chemical reactions, and radioactive decay should be considered in determining future likely conditions and chemical residuals remaining on site, for compliance considerations, design, and risk analysis.

This section may specify modeling of contaminant transport in air, ground water, or surface water, as appropriate. This section should be based on data needs identified by the risk assessor, for exposure point concentrations, for the designer, and regulatory specialist for issues impacting compliance, with input from the hydro geologist, chemist, and

air modeler. DQOs outlined in the SOW and defined in the workplan, will specify sampling requirements to support modeling. The Contractor should have previously, in data usability evaluation, determined whether data collected will meet modeling needs specified in these DQOs. Data gaps and uncertainties in analysis should be discussed. If modeling of surface water or ground water is required, refer to the geotechnical requirements, section 6, of this SOW. Refer to section 7, Air, if air transport modeling is required. Cross reference with those sections to assure consistency.
****

2.6 Task 6 Baseline Risk Assessment

****
Project team and member responsible for risk assessment shall specify level of effort required for the risk assessment based on customer specific requirements and regulatory restraints. The risk assessor should also be cognizant of any additional requirements set forth in state regulatory guidance and criteria, or provided by the customer or other agency, such as AEHA, in specifying requirements for Contractor preparation of the risk assessment. Army IRP and FUDS projects will require review and approval of risk assessment by AEHA for the Surgeon General, under AR 200-1, and team member should include AEHA representative in scoping and submittal evaluation process. Minimally, the format and content should follow EPA's "Risk Assessment Guidance for Superfund, Volumes I & II", 1989 (RAGS). Regulatory requirements or procedural basis for risk assessment follow from the NCP, 300.430, which describes the role of risk assessment in site evaluation and remedy selection. The program goal of the RI/FS is to propose and select remedies that are protective of human health and the environment. The results of the baseline risk assessment helps establish site remedial action goals and acceptable exposure levels for use in developing remedial alternatives, as defined in Part B and C of the RAGS.
****

2.6.1 Human Health Assessment

2.6.1.1 Identification of Chemicals of Concern

****
Data identified as required to support the risk assessment in the DQOs for the project, are evaluated in this section, in addition to the data evaluation section of the RI, to determine if data collected was of sufficient quantity and

quality as was specifically intended. If sampling design and analytical DQOs were formulated properly with the end use in mind, data to evaluate the nature and extent, which will support the fate and transport analysis and modeling, will be of sufficient quality and quantity to adequately evaluate exposure routes, exposure point concentrations, intakes, and the potential risks associated with a specific site.

DQOs for sampling requirements to support the risk assessment take into account statistical representativeness, bounds of the data, toxicity reference concentrations in determining detection limits, spatial representativeness to properly evaluate exposure routes, and quality assurance/quality control, specific sampling and analytical requirements to assure data may be used for risk quantification.

Selection of chemicals therefore must evaluate data quality and quantity sufficient to support the risk assessment by evaluating data by originally intended DQOs for quality with respect to sample quantitation limits, qualifiers and codes, blanks, background samples, frequency of detection, and statistical representativeness. Contractor must then present data for chemicals selected as the range of concentrations detected, frequency of detection, and sample quantitation limits. The values used to assess risk should be concentrations averaged for a chemical at a specific area expressed as the 95th percent upper confidence on the arithmetic average using standard statistical methods, if possible. DQOs for sample collection should take into account sufficient quantity of data is gathered to calculate a meaningful average concentration that populations may reasonably be expected to be exposed to over time. Data collected for modeling to calculate exposure point concentrations should also take into account sufficient data is collected such that the average value calculated represents a statistically meaningful value.

Those chemicals which have reasonable probability of occurring in background samples, such as naturally occurring metals or ubiquitous chemical constituents, should be screened as to whether they exceed statistically determined average background concentrations and whether chemicals may be attributed to operations/activities associated with the site.

Instructions should also be given regarding tabular format of information required, and specific data to be included in the risk assessment section of the RI. Preferably if site covers a large geographical area, risk analysis should

address each discrete source area separately, to aid in ease of evaluation, avoid unnecessary conservatism, and so that results of risk assessment may be easily integrated into remedial action objectives for discrete units.
****

2.6.1.2 Exposure Assessment

****
The conceptual site model, preliminarily developed by the project planning team, and further refined by the Contractor in the workplan and data evaluation section of the RI, is expanded further in this section as the basis for the exposure assessment. The source area, intermedia transport mechanisms, exposure routes, and populations are required to be evaluated by this section in order to define exposure pathways and to develop potential receptor intakes. In addition to detected contaminants, possible degradation mechanisms should be discussed, quantitatively, if appropriate. Each discrete source area for contamination of different media, if distributed over a large area, should be discussed separately. Contractor should identify and discuss all relevant exposure pathways, surface water transport, air dispersion, groundwater transport developed in the Fate and Transport Section, to calculate exposure point concentrations, for current and potential future exposures to identified receptors.

Exposure routes to be considered include: 1) ingestion of soils and water, as well as agricultural products such as fish, game, dairy and meat products, 2) inhalation of dusts and vapors through outside exposures, and exposures in dwellings/industrial, and 3) direct contact. Contractor should include a discussion as to why exposure routes are selected, and why others are eliminated from the evaluation.

(Note: Consider using EPA's Uptake BioKinetic Model (UBK) specifically for evaluation of exposures to lead contaminated sites, and determination of acceptable levels of lead in soils. UBK evaluates lead concentrations in different media and the predicted corresponding effect of blood lead concentrations.)

Populations initially identified in the conceptual site model, should be evaluated in more detail, as to those populations which may reasonably be expected to potentially come into contact with site wastes, by the identified exposure routes, both currently and in the future. Generally "worst case" assessments should be avoided as unrealistic.

Receptors should be identified with full consideration given to all potential limiting factors; census projections, community master plans, zoning, intended resource and quality of life considerations in predicting future land use. Cross referencing with environmental risk assessment current and future use scenarios will be required in identifying realistic potential exposure scenarios for humans. It is important that a balance be maintained in identifying receptors and potential exposure scenarios between attempting to identify all potential risks to human health and factors that may realistically prevent those exposures.

Intakes for exposure routes; ingestion, inhalation, dermal contact, should be calculated using exposure point concentrations and default values available in the EPA "Exposure Factors Handbook", 1990, and values published by each EPA region. These parameters include accepted default values for average body weights, averaging times for chronic/acute exposures, and contact rates for exposures. Exposure duration and frequency of exposure are site specific evaluations of the realistic expectations for exposure, rather than defaults. Additionally, Contractor should differentiate between the reasonable maximum exposure and an average exposure intake, as well as subchronic vs. chronic exposures, and non-carcinogenic and carcinogenic intakes.

All calculations used in the assessment should be documented within the text as well as all references used in the analysis.
****

2.6.1.3 Toxicity Assessment

****
The toxicity assessment is a descriptive section of the risk assessment in the RI/FS report that summarizes applicable available toxicity information for identified chemicals of concern. It is recommended that Contractor use information from the following sources in order of hierarchy suggested: 1) IRIS (Integrated Risk Information System), an EPA database which is updated frequently with verified toxicity information, 2) Health Effects Assessment Summary Tables (HEAST), 3) EPA Criteria Document, 4) ATSDR Toxicological Profiles, 5) EPA Environmental Criteria and Assessment Office (ECAO), 6) open literature, in identifying specific toxicity values, such as reference doses and slope factors. General toxicity information for chemicals is available from a variety of sources of information including other data bases. If no information is available regarding a chemical

the Contractor is encouraged to contact USACE risk assessment team member for recommendations, rather than EPA directly.

The descriptive sections or toxicity profiles should minimally include a summary of the study used to derive reference doses and slope factors, confidence, weight of evidence, indicated effect, and the selection criteria regarding specific values for the exposure durations indicated for the risk assessment. These could include acute exposures, chronic exposures, and subchronic exposures developmental effects for non-carcinogens, and chronic exposures only for carcinogenic effects.

The summaries of the toxicity assessments should be within the body of the risk assessment with any accompanying full text included in an appendix to the risk assessment or RI.
****

2.6.1.4 Risk Characterization

****
In this section, the Contractor will be required to quantitatively compare site specific chemical intakes to referenced toxicity values to derive a numerical evaluation of adverse health effects or risk associated with potential exposures. Contractor should clearly identify, in a tabular format, risks, hazard indices associated with each chemical for each route of exposure, and additionally, the summation of chemicals over all pathways, and conversely the summation of each pathway to derive a total hazard index or risk.

Additionally, risk characterization may also require a comparison of the quantitative risk in the baseline risk assessment to the qualitative risk statements issued by the ATSDR when a health assessment has been prepared for an NPL facility.

Contractor will be expected to discuss all results within the body of the text, including uncertainties and limiting factors associated with quantitation, and provide a summary of all results.

Those risks or health hazards which are determined to fall outside the range of acceptable risks (lE-04 to lE-06), or health hazard index above unity, will be used to establish preliminary remedial action objectives based on identified risks or health hazards associated with a pathway, chemical and population. These preliminary objectives shall be included in the summary of the risk assessment and will be

forwarded to the feasibility study to establish remedial action goals. Parts B and C of the Risk Assessment Guidance for Superfund, provide additional instruction in regard to risk evaluation for site decision requirements. Additionally, the summary and conclusions of the baseline risk assessment shall be forwarded for qualitative analysis of risk associated with each alternative as compared to the "no action" or baseline alternative. Risk Assessor team member should also specify that the Contractor should consult USACE, before providing any recommendations or conclusions for the risk assessment. It should be understood that authority and responsibility for environmental decisions remain with the Government, rather than at the discretion of the Contractor.
****

2.6.1.5 Uncertainty Analysis

****
An essential part of the risk assessment process is the uncertainty analysis. Numerical and non-numerical evaluations of errors and uncertainties associated with sampling design and analysis, fate and transport, intake assessment, toxicity assessment, and risk characterization should be discussed so that customer has an indication of limitations of the results or risks calculated in making an informed decision regarding remediation. Each section of the risk assessment should include a full uncertainty analysis, which may be qualitative, but is in some cases more useful from a quantitative perspective. Evaluation should include degree of false positives expected, and false negatives, and in what manner errors may effect overall decision making and site management. DQOs originally determined should take into account acceptable error expected in the risk assessment based on quality and quantity of data collected, and should be referenced in this analysis.
****

2.6.2 Environmental Evaluation

****
The environmental evaluation is less straightforward than the human health evaluation. In some ways, it may be complicated by competing exposure pathway analysis for human receptors, particularly in defining potential environmental populations and in determining remedial action objectives. Although not necessarily stated, neither assessment takes precedence over the other in weighing remediation requirements. Although the requirement for performing the environmental evaluation

finds its authority in CERCLA Section 121, the requirement is intended to respond to other applicable statutes including Endangered Species Act, Wild and Scenic Rivers Act, Marine Protection, Research and Sanctuaries Action, Fish and Wildlife Conservation Act, Migratory Bird Treaty Act, the Marine Mammal Protection Act, as well as state and local laws.

Though some elements of the human health risk assessment are similar to the environmental evaluation, selection of chemicals of concern, exposure assessment, toxicity assessment, and risk characterization, the information and criteria for each step in the evaluation are usually separate from the human health evaluation and original to the environmental evaluation. DQOs proposed to support the environmental assessment for sample design and analysis, may have some overlap with the human health assessment, but for the most part are unique statements.
****

2.6.2.1 Identification of Chemicals of Concern

****
DQOs developed specifically for the environmental evaluation, using the preliminary conceptual site model for environmental receptors as a guideline, are restated in this section to evaluate quality and applicability of data collected to originally intended purposes.

The environmental evaluation may require unique analytical methods, such as metal speciation, dissolved and total metals, and biological and chemical oxygen demand, and unique sampling designs to properly evaluate potential exposures. Depending on site specific regulatory requirements and customer requirements, the degree of testing may be limited to chemical testing, or may involve site specific toxicity testing. Regulatory authorities responsible for determining planning and preservation of ecological environments should be consulted to determine critical information regarding current future use of the area, and other specific concerns so that DQOs and conceptual site model may be focused for actual intended uses.

In this section, the Contractor will be required to evaluate data collected for quality and usability, with regard to DQOs originally formulated. Included would be evaluation of detection limits with toxicity reference concentrations, data quality indicators, and statistical representativeness.

Contractor shall include acceptable data collected in tabular format, indicating range of concentrations, frequency of detection and detection limits of the analytical methods. Additionally, Contractor will be required to determine the 95th percent upper confidence on the arithmetic average using standard statistical methods, if possible. DQOs for sample collection should take into account sufficient quantity of data is gathered to calculate a meaningful average concentration that populations may reasonably be expected to be exposed to over time. Data collected for modeling to calculate exposure point concentrations should

also take into account sufficient data is collected such that the average value calculated represents a statistically meaningful value.
****

2.6.2.2 Exposure Assessment

****
The conceptual site model, preliminarily developed by the project planning team, and further refined by the Contractor in the workplan and Data Evaluation Section of the RI, is expanded further in this section as the basis for the exposure assessment. The source area, intermedia transport mechanisms, exposure routes, and populations are required by this section to be evaluated in order to define exposure pathways and develop potential receptor intakes. The Contractor should identify and discuss all relevant exposure pathways, surface water transport, air dispersion, groundwater transport developed in the Fate and Transport Section, to calculate exposure point concentrations for current and potential future exposures to identified receptors.

Populations initially identified in the conceptual site model should be evaluated in more detail, such as results from mapping ecological and terrestrial environments, as to those populations which may reasonably be expected to potentially come into contact with site wastes, by the identified exposure routes, both currently and in the future. Critical habitats, threatened and endangered species, wetland environments, should be identified and documented as well as other populations present. Cross reference to Section 2.10.6, NEPA Compliance Activities, to assure the Contractor is not tasked twice to do this work. The most important factor in developing a valid environmental evaluation is

properly determining potentially exposed populations. Project planning team should consult U.S. Fish and Wildlife, State and local resource coordinators and the National Oceanic and Atmospheric Administration to aid in determining potentially exposed environmental populations for the preliminary conceptual site model development and DQOs. Additionally, project planning team should be sensitive to any potential overlaps in identifying receptor populations for human health and environmental populations for current and future use. It is recommended that a representative population should be chosen from the various species identified, to evaluate the overall impacts for the community of plants and/or animals that could be exposed.

The combined human health and environmental assessments should be a cohesive interpretation of potential future use conditions in determining potential impacts to human health and the environment, rather than separate and detached. Conclusions of both assessments will have a direct bearing on remedial action goals and therefore remediation requirements.

Intakes for exposure routes; ingestion, inhalation, dermal contact, should be calculated using exposure point concentrations and reasonable intake parameters that can be assimilated into an environmental assessment. EPA regional environmental assessment groups, and state authorities may be helpful in determining these intake values. These parameters include reasonable values for average body weights, averaging times for chronic/acute exposures, and contact rates for exposures. Exposure duration and frequency of exposure are site-specific evaluations of the realistic expectations for exposure, rather than defaults. Additionally, the Contractor should differentiate between the reasonable maximum exposure and an average exposure intake, as well as subchronic vs. chronic exposures, and non-carcinogenic and carcinogenic intakes.

All calculations used in the assessment should be documented within the text as well as all references used in the analysis.
****

2.6.2.3 Toxicity Assessment

****
The toxicity assessment is a descriptive section that summarizes applicable available toxicity information for identified chemicals of concern. It is recommended that Contractor use information available from sources discussed in

Section 2.6.1.3 as well as the NIOSH Registry of Toxic Effects of Chemical Substances (RTECS), EPA specific toxicity studies performed for specific chemicals of concern, and information provided by regional EPA environmental assessment groups. General animal toxicity information for chemicals that may be used in a qualitative comparative analysis is available from a variety of sources of information. Quantitative toxicity evaluation data is not usually available, however, for environmental assessments for general use. Contractor may propose quantitative evaluation if procedures are reviewed and approved by USACE risk assessment team member in conjunction with regional EPA environmental assessment group.

The descriptive sections or toxicity profiles, should minimally include a summary of study used to toxicity values, indicated effect, and criteria for selecting specific values for the exposure durations indicated for the risk assessment, such as acute exposures, chronic exposures, and subchronic exposures developmental effects for non-carcinogens, and chronic exposures only for carcinogenic effects.

The summaries of the toxicity assessments should be within the body of the risk assessment, with any accompanying full text included in an appendix to the risk assessment or RI.
****

2.6.2.4 Qualitative Risk Assessment

****
A narrative discussing comparatively potential adverse health effects expected based on potential intakes of the representative populations and toxicity values should be included in this section. Quantitative analysis is not necessary, in view of lack of toxicity information, and/or if not requested specifically by the customer or regulatory authority.

Minimally, tabular format comparing toxicity information with expected intakes and an explanatory analysis should be sufficient.

If a quantitative analysis is required or requested, site-specific as well as literature values should be used to numerically evaluate the potential for adverse health effects or cancer, using advice from specific technical experts from effected regulatory agencies.
****

2.6.2.5 Uncertainty Analysis

****
Numerical and non-numerical evaluations of errors and uncertainties associated with sampling design and analysis, fate and transport, intake assessment, toxicity assessment, and risk characterization should be discussed so that customer has an indication of limitations of the results or risks calculated in making an informed decision regarding remediation. Each section of the risk assessment should include a full uncertainty analysis, which may be qualitative, but is in some cases more useful from a quantitative perspective. Evaluation should include degree of false positives expected, and false negatives, and in what manner errors may effect overall decision making and site management. DQOs originally determined should take into account acceptable error expected in the risk assessment based on quality and quantity of data collected, and should be referenced in this analysis.
****

2.6.3 Risk Summary, Risk Management Recommendations, and Identification of Preliminary Remedial Action Objectives

****
The risk assessment is used to identify the hazards or risks at a site so that management decisions can be made accurately with regard to environmental regulations and expenditures for the degree of response action required. The Contractor is required to state the conclusions of the risk assessment in this section, with directions for specific content given by the USACE risk assessor. The risk management discussion following the summary, should be based on specific requirements provided by the USACE risk assessor. This is a Government In Nature (GIN) decision discussion, and the Contractor shall refrain from editorializing or developing this section without specific content requirements and recommendations supplied by the USACE risk assessor. Content requirements of the risk management section include a quantitative discussion of inherent uncertainty associated with risk characterization and development of a range of risk to determine remediation goals, rather than the single value provided by the risk assessment.

Using this range of risk values, Contractor will be required to develop remediation goals, which are refined from Preliminary Remediation Goals, developed for the workplan, in accordance with Part B, Risk Assessment Guidance for

Superfund, Volume I from EPA. The risk range, taking into account numeric uncertainties from the risk characterization, is used a the target risk values in determining remediation goals/cleanup levels. These will be reintroduced in the Remedial Action Objectives section of the Feasibility Study, with the ARARs in determining overall remediation goals and remedial alternatives for the site. The entire team should participate in the identification of the remedial action objectives.
****

2.7 Task 7 RI Report

****
Provide details on content and format of the RI report under this task. Refer to EPA RI/FS guidance as to content and format. For scheduling, see the Project Management Section. The development on the content and format should be by the team. The regulator agencies who review the report and the customer or compliance agreements may also dictate the content and format. Make sure this is clearly spelled out in the SOW and not left up to the Contractor. Remember the format and content may change as more or new information is developed on the project.
****

2.7.1 Pre-Draft Data Package

****
As specified in section 2.4.3 a pre-draft final report deliverable will be submitted to the QA laboratory for comparison between the data generated from the Contractor's QC and the USACE QA laboratories. This review also encompasses an assessment of the internal quality control and method requirements, allowing a determination on the adequacy of the data generated during the project. This deliverable should contain at a minimum all chain of custody forms and those items outlined within the 16 August 89 memorandum entitled Minimum Chemistry Data Reporting Requirements for DERP and Superfund HTW Projects. The timeliness of the USACE generated QA/QC Report will be contingent upon the completeness of the data compilation and the punctual release of this material.
****

2.7.2 Draft RI

****

This section should address the draft document and any special requirements. The scoping team needs to determine the type of draft documents that the Contractor will need to delivery. It may be advisable that the scope identify a draft that will be provided and reviewed by the team and user prior to submittal to the regulator agencies. The Contractor will then incorporate the comments from the team into a draft that will be submitted to the regulator agency or agencies for review and comment. This will assure that a quality product is provided to the regulatory agency and it meets the requirements of the team and user.

It should be noted and the team should understand that during the review process additional questions or concerns could be raised that will need to be addressed. To address these issues, additional field work may be required which would result in another document being submitted. These additional requirements can not be clearly identified in the initial scope and any additional effort should be closely coordinated with the team and user.
****

2.7.3 Final RI

****
The scoping team needs to determine the general content requirements of the final document that the Contractor will be required to deliver using expert judgement, USACE guidance, and EPA RI/FS guidance. Based on the complexity of the project, the Final RI report requirements may not be able to be scoped at this time. It may be advisable that the Final RI be scoped as a new deliverable after the Draft RI has been reviewed and all additional RI work has been completed. The team and user should review the Final RI before it is provided to the regulatory agencies. The Contractor should incorporate the comments from the team into the Final RI and then submit to the regulatory agency or agencies. This will assure that a quality product is provided to the regulatory agency and it meets the requirements of the team and customer.
****

2.7.4 DPM

****
Contractor should provide a list of information, specified by the project team, that will be used by DOD personnel to score the site per the Defense Priority Model. This information compiled from data included in the RI report, will enable DOD

personnel to easily evaluate and score sites and to determine priority for remediation. List of information required should be specified from DPM User's Manual.
****

2.8 Task 8 Remedial Alternatives Development and Screening

****
See Enclosure 11, Alternative Selection for discussion of the requirements. Development of alternatives should be concurrent with other RI/FS activities. As soon as the contaminated media and the nature of the contamination are discovered, the process engineers can start to identify appropriate types of treatment. Analyses for substances that may interfere with treatment can be conducted on splits of samples taken for completion of the characterization analyses.
****

2.8.1 Develop Remedial Action Objectives

****
The preliminary remedial action objectives developed previously are reiterated in this section, as a summary of PRGs/risk based cleanup levels and ARARs for the site which the remediation goals are based on. Alternatives are identified and developed relative to these goals.
****

2.8.2 Establish General Response Actions
2.8.3 Identify and Screen Technologies
2.8.4 Configure and Screen Alternatives

2.9 Task 9 Treatability Studies and Treatability Study Reports

****
See Enclosure 12 to the ETL: Treatability Studies and Treatability Study Reports for more detail on the content of this section of the scope-of-work and additional guidance on scoping treatability studies. Treatability study reports may be submitted concurrently with the RI/FS or separately.
****

2.9.1 Treatability Study Workplans
2.9.2 Treatability Studies

2.10 Task 10 Detailed Analysis of Alternatives

****
See Enclosure ll, Alternative Selection for discussion of the requirements. Development of alternatives should be concurrent with other RI/FS activities.
****

2.10.1 Technical Description of Alternatives and Applicable ARARs
2.10.2 Detailed Analysis of Alternatives.
2.10.3 Performance Modeling

****
This section should describe any modeling required to assist in the analysis of the alternatives. The general objectives of the modeling should also be noted here and the Contractor should be directed to elaborate on the objectives depending on the alternatives. This section should be developed with input from the process engineer, the hydrogeologist, the chemist, and the industrial hygienist (particularly for air dispersion modeling). This part of the SOW should refer to the sections on ground water modeling within the Geotechnical Requirements (Section 6.9), if applicable, and the air section (Section 7). These other sections provide the specifications for the performance of modeling. This section should also be cross referenced with other parts of the SOW that relate to modeling, such as Risk Assessment (Section 2.6) and Fate and Transport Analyses (Section 2.5.2) to assure that modeling efforts are not duplicated.
****

2.10.3.1 Ground Water
2.10.3.2 Contaminant Transport
2.10.3.3 Geochemical Modeling
2.10.3.4 Atmospheric Dispersion Modeling

****
There are several types of atmospheric dispersion modeling that may be performed during all phases in the process of investigation and feasibility study. The feasibility study data needs requirements should include evaluation of air emissions associated with specific treatment alternatives to determine controls/actions levels required for compliance the with the Clean Air Act, and risk to human health and environmental receptors. Modeling performed for the Remedial Investigation to support the baseline risk assessment may not have addressed these specific requirements for alternative analysis, however models used for baseline analysis may be expanded for specific features evaluated in alternative

analysis. For instance, if evaluation of off-gassing impacts associated with soil vapor extraction alternatives is required, the modeling performed for soil-air intermedia transport of volatile chemicals under the RI fate and transport analysis may be expanded to meet this need. This section should be cross referenced with section 7, Air.
****

2.10.4 Cost Estimates

****
This section should require cost estimates for feasibility studies which are detailed to a level commensurate with the level of design, with appropriate design contingencies applied to relevant cost items. The section should note that alternative estimates for feasibility studies, however, do not always include all the costs necessary for remediation of an HTRW project. If the sole purpose of estimating alternatives is the selection of the method of remediation and not the total construction or project cost, some items may not require pricing. Costs which are minor, or costs which don't vary between alternatives but are common to all, are frequently not included since they would not impact the selection of an alternative. This is not a problem as long as there is documentation in the report that identifies which costs are, and which are not, included in the estimate. The SOW should require this documentation. The selected alternative however, should reflect the total project cost of the remediation. The scope should require the Contractor to prepare estimates which consider all the following costs associated with the selected alternative. These must be considered if a total construction cost is needed for budgetary and/or programming purposes.

This section should be prepared with input from the appropriate cost engineering staff.
****

2.10.4.1 Construction Costs

****
Consult a construction representative, preferably in a resident office to get some insight into day-to-day tricks and hidden costs. The scope preparer may be able to avoid additional costs by carefully preparing the scope based on knowledge gained by construction representatives. This should be done by project leader.
****

2.10.4.1.1 Off-site utility Connections and Fees
2.10.4.1.2 Mobilization/Demobilization
2.10.4.1.3 Health and Safety
2.10.4.1.4 Permits and Fees
2.10.4.1.5 Testing and Analyses
2.10.4.1.6 Operation and Maintenance
2.10.4.1.7 Transportation Costs
2.10.4.1.8 Disposal Costs
2.10.4.1.9 Contractor's Overhead
2.10.4.1.10 Contractor's Profit
2.10.4.1.11 Performance Bond
2.10.4.2 Markups

****
The SOW should require the Contractor to consider standard percentages as given in Army technical cost engineering guidance. The following markups should be applied to the construction cost to determine the total project cost:
****

2.10.4.2.1 Cost Growth to Construction Midpoint
2.10.4.2.2 Construction Contingency
2.10.4.2.3 Supervision and Administration
2.10.4.2.4 Engineering and Design During Construction
2.10.4.2.5 Additional Lab Testing
2.10.5 Plans/Schematics/CADD

****
This section would present requirements for the preparation of any drawings necessary for the FS as well as describe any compatibility requirements if computer-aided design and drafting (CADD) is to be used.
****

2.10.6 NEPA Compliance Activities

****
This section describes the consideration the Contractor will need to give to compliance with NEPA. Note that NEPA applies. If the site is an Army NPL site, review AR 200-2. The RI/FS can be called a "functional equivalent" if all requirements in AR 200-2 are fulfilled. If site is not an Army NPL site, the RI/FS process must meet full NEPA requirements. Project leader should discuss this with your

NEPA expert and office of counsel for specific elements to include in the scope. For non-Army NPL sites, coordinate with the customer to determine NEPA requirements.
****

2.10.6.1 Wetlands Determination

****
Normally the Corps has the regulatory responsibility for wetlands determination and has an organization available to develop the determination. It is recommended, however, that the Contractor be required to perform a preliminary wetlands evaluation, if appropriate for the site. Based on the results of this preliminary evaluation, a more detailed determination can be made by the Corps. Reference the Corps of Engineers Wetlands Delineation Manual, 1987. The Contractor should be informed by this scope section of the potential for wetlands at the site and their responsibility in the wetlands determination process should be outlined. This section should describe the steps that will be taken by the government for a final determination of the presence of wetlands and how that may affect the feasibility study. Cross reference Section 3.5.11 Government Support - Wetlands Determination if the Corps will provide the determination. This section would require input from resource specialists normally found in the regulatory branches of operation divisions in Corps districts. This would require coordination with other regulatory agencies.
********** **********

2.10.6.2 Flood Frequency/Flood Plain Analysis

****
This section would require the Contractor to evaluate the location of the site relative to the flood plain of nearby surface streams. If the site being investigated is located in an apparent flood plain (it would be sufficient to use a Federal Emergency Management Agency [FEMA] Flood Insurance Rate Map [FIRM] or a FEXA Flood Hazard Boundary Map [FHBM] to make this determination if either one is available for the site), steps need to be taken to estimate the frequency of flood depths and velocities that can be used to characterize the potential flood problems associated with any plan that may be put into effect to stabilize the site. This section should be developed by a hydrologic engineer. Cross reference the requirements in Surface Water Modeling, section 6.9.
****

2.10.6.3 Assessment of Cultural Resources

****
This section would require the Contractor to assess the archeological, historical, and cultural resources of the site relative to the applicable criteria referenced above. This section should be developed with input from resource specialists, often located in the Corps' planning divisions.
****

2.11 Task 11 FS Report

****
Provide details on content and format of FS Report under this task. Refer to EPA FS guidance as to content and format of the FS Report. For scheduling refer to the Project Management Section. The regulatory agencies who review the report and the customer or compliance agreements may also dictate the content and format. Make sure this is clearly spelled out in the SOW and not left up to the Contractor. Note that the format and content may change as more or new information is developed on the project.

The scope should note that the Contractor and/or design agency recommends an alternative to the customer or decision maker. The recommended alternative is not necessarily the least costly and does not always meet all of the ARARs, and selection is a risk management decision. The report should go no farther than a recommendation. Discussion of the bases for selection is included with the recommendation. Final selection of an alternative is the responsibility of the decision maker or customer after consideration of input from the concerned parties and the public.
****

2.11.1 Draft FS

****
See discussion on Draft RI. Same procedures and requirements may apply.
****

2.11.2 Final FS

****
See discussion on Final RI. Same procedures and requirements may apply.
****

2.12 Task 12 Post RI/FS Support

****
Provide details on content and format for the effort

requested under this task. Refer to EPA RI/FS guidance. For scheduling see section on Project Management.
****

2.12.1 Proposed Plan
2.12.2 Draft ROD/Decision Document

****
The draft ROD is required to substantially duplicate the detailed analysis of alternatives in Enclosure 11.
****

2.12.3 Cost Estimate

****
Estimate for programming funds for the remedial action(s).
****

3. Project Management

****
The items under this heading describe some of the requirements relevant to project management; including schedules, submittals, points of contact, etc. These requirements would largely be prepared by the USACE project manager in coordination with the project team. The term "project manager" is used to reference either project manager or technical manager at the districts. It is important that the project manager utilize the TOTAL QUALITY MANAGEMENT and PROJECT MANAGEMENT ER 5-7-l(FR) principals as tools on a RI/FS project, and the PROJECT MANAGEMENT ER 5-7-1(FR) guidance is a good example of implementation guidelines for these principles and should comply with these requirements. The project manager must utilize the members of the total team to the fullest, by facilitating discussions between data users, decision makers, and data implementors. The project manager can not make technical or political decisions without the support of the team. For an RI/FS project to really succeed all members of the team must be involved in the planning process. The extra effort in coordinating with the total team will save time and money in the end. Not involving the total team will cause delays, cost to the project and cost increases to the alternatives. Note that

all delays, no matter how small, will result in delays and cost increases to the total project.
****

3.1 Project Manager

****
Require the Contractor to identify single project manager. In some cases the Contractor may have a team approach to management, the Contractor should be required to identify one single project manager for the USACE. Also, the Contractor should identify other members of the design team. The Contractor should not be allowed to change project manager or major team members without notifying the USACE project manager. The requirements for the Contractor should be clearly spelled out under this section.
****

3.2 Coordination with Other Entities

****
Of major importance is coordination with regulators, one of the site decision makers, along with the customer. Be cooperative, but don't play dead. Know the basic regulations and put these applicable regulations into the scope (see Section 1.6) so that the Contractor is also aware of any applicable regulations.

Identify to the Contractor the limits on dealings with regulatory agencies under this section. A standard operating procedure needs to be established between USACE, the Contractor, and the customer on how to handle site visits and oversight by enforcement agencies. Site visits by enforcement authorities must be managed by DOD staff, not Contractors, in order to protect DOD interests. At active federal facilities, it is advisable to involve the installation staff in review and comment on this section.

Also identify in the scope to the Contractor that this Coordination is not just limited to the typical regulatory agencies but also to the federal, state, and local governmental and non governmental agencies that may have an effect on project constraints such as the project schedule and possibly decisions such as the alternative selected.

It is recommended that the team try to identify the various entities needing coordination during the RI/FS. The Contractor should be required to identify any other entities with whom coordination would be required for the alternatives

being evaluated. Identification of entities is an ongoing process as the project moves along and should be a requirement of the Contractor. Don't assume the Contractor will do this without direction.
****

3.3 Conference Notes

****
The Contractor should be required to submit notes for conferences and any meetings that they attend in reference to this project. These are important documents that the Contractor should be tasked to perform. They document the decision process and the Contractor should provide them as soon as possible after the meeting or conference. A time period after the meeting should be established for the distribution on the conference notes. Also identify the distribution requirements of the conference notes here or under submittals. The Contractor should be reminded that only factual information be provided. This information may be used in legal actions.
****

3.4 Confirmation Notices

********** **********
The Contractor should be required to provide originals of all telephone conversation records or confirmation notices that the USACE project manager or the customer may deem necessary. This may include any contact with any regulatory agencies, cost estimating, and any decision process. These requirements need to be clearly spelled out for the Contractor in the scope. Note that the more detailed the records are, the more cost. The Contractor should be reminded that only factual information be provided. This information may be used in legal actions.
****

3.5 Government Support

****
Clearly identify to the Contractor what will and will not be provided as support from the government. This will require close coordination with the customer (EPA, Facility Engineer, etc.). Delays in providing the support will results in possible cost to the Contractor who will claim that cost against the government. Surveys, permits, and rights of

entry are very important in a successful completion of a project.
****

3.5.1 Government Provided Data and Information
3.5.2 Existing Plans/Surveys/Air Photos
3.5.3 Utilities

****
This section would identify any utilities available for use by the Contractor, including water source, electricity, wash racks, phone service. This requires careful coordination with the installation, since the installation will in general be providing this directly to the Contractor.
****

3.5.4 Permits

****
This section would describe any permits such as digging, discharge, or well permits the government would obtain for the Contractor. Cross reference to section 6.1.4.
****

3.5.5 Rights of Entry
3.5.6 Security
3.5.7 Equipment Storage/Staging Areas
3.5.8 Temporary Office

****
Again, this would require careful coordination with the installation.
****

3.5.9 Grading and Site Restoration
3.5.10 Cuttings/Spoil Disposal

****
See notes under the Investigation-Derived Wastes Section. All waste disposed of off-site must be disposed of in accordance with federal and state solid and hazardous waste requirements. This may be a service provided by the Corps under a separate contract or by the installation through a Defense Reutilization and Marketing Office.
****

3.5.11 Wetlands Determination
3.5.12 Explosives Clearance

****
As stated in the National Contingency Plan 300.120, DOD will be the removal response authority with respect to incidents involving DOD military weapons and munitions (or weapons and munitions under DOD custody, control, or jurisdiction). In the event that DOD weapons or munitions are present onsite, a representative from the Ordnance and Explosive Waste (OEW) Mandatory Center of Expertise (MCX) and Design Center, located in Huntsville, AL shall be provided as the On-Scene Coordinator (OSC)/Remedial Project Manager responsible for taking all removal actions.
****

3.6 Travel and Meetings

****
The number and types of meetings should be clearly identified under this section. Any special requirements or type of disciplines that are required for certain meetings should be included in the scope. The requirements identified here will dictate the cost that the Contractor will submit. Remember to verify that the Contractor provides what was negotiated.

The following is a list of meetings that may be required under this scope. It should be noted that the number and type of meetings will depend on the type of documents that the Contractor will be providing. For example, a pre-draft meeting may be held to review the team and user comments and discuss the documents with the Contractor before the revised document is forwarded to the regulating agencies. The draft report meeting should be with the regulator agencies and the Contractor to discuss the comments from the regulator agencies. Additional special meetings may be required based on the complexity of the project and should be coordinated with the team and user during the scoping.
****

3.6.1 Site Walkover
3.6.2 Draft Workplan Meeting/Field Work Start-up Meeting
3.6.3 RI Pre-Draft Report Review Meeting
3.6.4 RI Draft Report Meeting
3.6.5 RI Final Report Review Meeting
3.6.6 FS Pre-Draft Report Review Meeting
3.6.7 FS Draft Report Meeting
3.6.8 Treatability Study Meeting (if required)
3.6.9 FS Final Report Review Meeting
3.6.10 Public Meetings
3.6.11 Site Visits

3.6.12 Additional Trips

****
Verify that the appropriate additional trip clauses are included in the contract.
****

3.7 Schedules

****
The project manager will need to provide a schedule to the Contractor in the scope. This will allow the Contractor to develop the estimate on the needs of the government. The Contractor should be required in the scope to develop a more detailed schedule to support the cost estimate that is submitted. This would be a helpful tool in negotiations. Realistic schedules that are well developed and thought out will prevent problems in the long run with the negotiations with the Contractor, with the customer, and with regulatory agencies. The project manager should be realistic about schedules and they need to develop them around the TOTAL QUALITY MANAGEMENT and PROJECT MANAGEMENT principals developed by USACE, in the project planning guidance document, and ER 5-7-1(FR).

When developing a schedule, all projects aspects should be considered by the project manager and team. The project manager cannot develop a schedule without input from the total team. (Technical, Contracting, Office of Counsel, Customer, Resource Management, etc.). These considerations must also include the review times required by regulatory bodies and non-regulator agencies (such as AEHA) that may affect the schedule. The project schedule must consider the requirements of any Federal Facility Agreement (FFA), consent order, memorandum of understanding, etc.

Development of a RI/FS schedule is very difficult when other governmental agencies are involved in providing information, reviews, or the decision process. Using this outline can help in development of a schedule by estimating the time frame for each activity. Project managers must remember in developing a schedule that the USACE has control only over the people under USACE control. Uncertainties and contingencies must be considered.

The Contractor should be required to use critical path/time line tools in developing the schedules that can graphical provide the various components of the schedule and milestone

dates. This will help in identifying parallel activities that may effect the schedule.
********** **********

3.8 Submittals

****
This section summarizes the submittals expected during the course of the RI/FS project. No technical requirements are presented here.

The type and number of reports should be coordinated with the customer and the various reviewing agencies. Also special considerations should be taken as to what type or kind of submittal certain agencies should receive.
****

3.8.1 General Submittal Requirements
3.8.2 Document Submittal Register

****
The type of submittal, number of copies, and who are required to receive the submittals are specified here. The register identifies who will receive copies of the submittals. This listing should include, as a minimum, POC name, title, address, telephone, and facsimile. During the course of the project this listing will need to be updated.
********** **********

3.8.3 RI/FS Workplans

****
The requirements for these plans are detailed in the various technical sections or guidance documents.

As a matter of background, the Project Workplan is intended to be a single project document, with individual plan requirements, CDAP, SSHP, CRP, MWIP and TSP, as attachments to that plan, rather than separate deliverables. All background information, project strategy, data quality objectives, and data collection design requirements are included in the Project Workplan. Implementation requirements, field sampling techniques, analytical protocols, and well construction requirements, are included in the plan attachments. There should not be duplication of Project Workplan material included in the attachments, and plan attachments should rely on the main workplan to provide all general and overall project information which may have an effect on plan attachment preparation. Information such as organizational struc-

ture and responsibilities should also be included in the main workplan for each area of interest rather than in the plan attachments.
****

3.8.3.1 Project Workplan
3.8.3.2 Chemical Data Acquisition Plan (CDAP) Attachment
3.8.3.3 Monitoring Well Installation and Drilling Plan (MWIP) Attachment
3.8.3.4 Site Safety and Health Plan (SSHP) Attachment
3.8.3.5 Community Relations Plan (CRP) Attachment
3.8.3.6 Treatability Study Workplan Attachment

3.8.4 Progress Reports

****
The type and requirements for reports that the Contractor will be required to provide or submit would be discussed under this section. The requirements for these submittals should be identified on the Corps' schedule or the Contractor' s schedule.
****

3.8.4.1 Monthly Progress Reports
3.8.4.2 Daily Quality Control Reports

3.8.5 Drilling Logs
3.8.6 Monitoring Well Construction Diagram and Development Record
3.8.7 Survey Documents
3.8.8 RI Report

****
The type and number of reports should be coordinated with the customer and the various reviewing agencies. Also special considerations should be taken as to what type or kind of submittal certain agencies should receive.
****

3.8.8.1 Pre-Draft Data Package
3.8.8.2 Draft RI
3.8.8.3 Final RI

****
Various draft documents may be considered for the following reports
****

3.8.9 Quality Control Summary Report
3.8.10 Treatability Study Report
3.8.10.1 Draft Treatability Study Report
3.8.10.2 Treatability Study Report
3.8.11 FS Report
3.8.11.1 Draft FS
3.8.11.2 Final FS

4. Health and Safety Technical Requirements

****
This section presents the technical requirements for health and safety. Refer to Enclosure 8 to the ETL for the suggested language for this SOW section.

Two topics, "Site Description and Contamination Characterization" and "Staff Organization, Qualifications, and Responsibilities" may be addressed as a portion of the workplan as outlined in section 2.1. In the event this material is addressed within the workplan (WP), the applicable WP sections should be referenced within these sections of the SSHP. Regardless of location, these topics should address the requirements contained in Enclosure 8.
****

5. Chemistry Technical Requirements

****
This section presents the technical requirements for performance of sampling and analysis activities. Specific requirements are discussed under the individual topics. Additional guidance on the typical content of this section is provided as Enclosure 13 to the ETL, Chemistry Technical Requirements. An outline of the section is provided here.
****

5.1 Introduction
5.1.1 CDAP Format and Implementation Requirements
5.1.1.1 Section 1. Table of Contents
5.1.1.2 Section 2. Project Background Data
5.1.1.3 Section 3. Chemical Requirements to Support Project DQOs
5.1.1.4 Section 4. Contractor Project Organization and Functional Areas of Chemistry Responsibilities
5.1.1.5 Section 5. Field Activities

5.1.1.5.1 Field Instrumentation and Equipment (Calibration and Maintenance)
5.1.1.5.2 Field Documentation

5.1.1.5.3 Daily Quality Control Reports (DQCRs)
5.1.1.5.4 QC and QA Field Samples
5.1.1.5.5 Decontamination Procedures
5.1.1.5.6 Matrix: Groundwater Samples
- 5.1.1.5.6.1 Field Screening
- 5.1.1.5.6.2 Locations
- 5.1.1.5.6.3 Sampling Procedure
- 5.1.1.5.6.4 Analytical Procedure
- 5.1.1.5.6.5 Sample Containers, Preservations, Holding Times

5.1.1.5.7 Matrix: Surface Water Samples
- 5.1.1.5.7.1 Field Screening
- 5.1.1.5.7.2 Locations
- 5.1.1.5.7.3 Sampling Procedure
- 5.1.1.5.7.4 Analytical Procedure
- 5.1.1.5.7.5 Sample Containers, Preservations, Holding Times

5.1.1.5.8 Matrix: Leachate Samples
- 5.1.1.5.8.1 Field Screening
- 5.1.1.5.8.2 Locations
- 5.1.1.5.8.3 Sampling Procedure
- 5.1.1.5.8.4 Analytical Procedure
- 5.1.1.5.8.5 Sample Containers, Preservations, Holding Times

5.1.1.5.9 Matrix: Soil Samples
- 5.1.1.5.9.1 Field Screening
- 5.1.1.5.9.2 Locations
- 5.1.1.5.9.3 Sampling Procedure
- 5.1.1.5.9.4 Analytical Procedure
- 5.1.1.5.9.5 Sample Containers, Preservations, Holding Times

5.1.1.5.10 Matrix: Sludge/Sediment Samples
- 5.1.1.5.10.1 Field Screening
- 5.1.1.5.10.2 Locations
- 5.1.1.5.10.3 Sampling Procedure
- 5.1.1.5.10.4 Analytical Procedure
- 5.1.1.5.10.5 Sample Containers, Preservations, Holding Times

5.1.1.5.11 Matrix: Air Samples
5.1.1.5.11.1 Locations
5.1.1.5.11.2 Sampling Procedure
5.1.1.5.11.3 Analytical Procedure
5.1.1.5.11.4 Sample Containers, Preservations, Holding Times
5.1.1.5.12 Matrix: Surface Samples
5.1.1.5.12.1 Field Screening
5.1.1.5.12.2 Locations
5.1.1.5.12.3 Sampling Procedure
5.1.1.5.12.4 Analytical Procedure
5.1.1.5.12.5 Sample Containers, Preservations, Holding Times
5.1.1.5.13 Matrix: Soil Gas Samples
5.1.1.5.13.1 Field Screening
5.1.1.5.13.2 Locations
5.1.1.5.13.3 Sampling Procedure
5.1.1.5.13.4 Analytical Procedure
5.1.1.5.13.5 Sample Containers, Preservations, Holding Times
5.1.1.5.14 Matrix: Drum / Tank Samples
5.1.1.5.14.1 Field Screening
5.1.1.5.14.2 Locations
5.1.1.5.14.3 Sampling Procedure
5.1.1.5.14.4 Analytical Procedure
5.1.1.5.14.5 Sample Containers, Preservations, Holding Times

5.1.1.6 Section 6. Sample Chain of Custody, Packing and Shipping
5.1.1.7 Section 7. Laboratory Activities
5.1.1.7.1 Cooler Receipt Form
5.1.1.7.2 Instrument Calibration and Frequency
5.1.1.7.3 Quality Control Procedures
5.1.1.7.4 Preventive Maintenance
5.1.1.7.5 Corrective Action
5.1.1.7.6 Data Reduction, Assessment Validation, and Documentation
5.1.1.8 Section 8. Chemical Data Quality Management Deliverables
5.1.1.8.1 Daily Quality Control Reports

****

This section presents the technical requirements for performance of the geotechnical activities. Specific requirements are discussed under the individual topics. This section should present the acceptable procedures and products to be used by the Contractor. This information allows an accurate estimate and proposal to be developed and minimizes the severity of the comments that may need to be made on the Contractor's workplans. The level of detail depends on the project and the Contractor's experience in working with the Corps. If the Contractor has done work for the Corps previously and is aware of these requirements, the scope may refer to previous contracts or work orders for these requirements, adding only those project specific changes. For indefinite delivery contracts, many of these requirements may be part of the primary contract, and need not be reiterated in each work order. In that case, only those project-specific requirements or changes from the contract requirements need be discussed here. If the requirements are not part of the primary contract, the SOW must present or refer to these technical requirements.

Unless otherwise noted, the language for each topic is to be developed by the hydrogeologist and/or geotechnical engineer

with concurrence of the chemist and industrial hygienist. The other team members need to be aware of these requirements because of the impacts on data quality and health and safety.

Most of the following sections require some description of the Contractor's proposed implementation in the workplans. Details related to drilling, monitoring well installation, geophysical surveying, infiltration/aquifer testing are to be proposed in the Monitoring Well Installation Plan Attachment. Other activities may require specific discussion in another supporting workplan attachment. Some activities will require specific analyses that are to be described in detail in the reports. Some activities also require specific submittals separate from these plans and reports. These are discussed under the individual topics.

Many of these activities will require coordination with the land owner or installation, and many of the intrusive activities will need utility clearances. Depending on the nature of the regulatory involvement, some activities (or the review of this section) may require coordination with regulatory agencies. Some of the coordination recommended here duplicates the advice provided under the Project Requirements Section, but is provided here as well to assure that the coordination is done.

In general, many of these sections should be cross referenced to the Chemistry Technical Requirements (Section 5.) or the Sample Analyses, Data Assessment and Reporting Section (2.4) because of the interrelated nature of field sampling for chemical analysis. There should be no duplication with the Field Investigations Section (2.3). This section only provides the general technical requirements for performance, not the specifics on sampling location, numbers, and analyses.
****

6.1 General Specifications

6.1.1 Qualified Hydrogeologist/Geotechnical Engineer

****
This section would specify the minimum requirements for the experience, training, or registration/certification of the Contractor's project hydrogeologist, hydrogeologist/engineer in the field, or project geotechnical engineer. Information on general organization structure and responsibilities in the General Project Workplan should not be reiterated in the plan attachment. This decision may depend on the complexity

of the project or its critical nature. The more experience required, the higher the labor rates the Contractor will propose, though the higher cost may yield a better product. The Contractor should be required to submit the hydrogeologists' or engineers' resumes along with the chemists in the CDAP.
****

6.1.2 Applicable Driller and Surveyor Permits and Licenses

****
In some cases, it may be necessary to require the use of a driller or surveyor licensed in the state in which the project is located. If required, this should be discussed in negotiations or in the workplans. Drillers and surveyors employed by the Corps should not need to be licensed, but use of licensed drillers or surveyors may be required if the work is to be contracted.
****

6.1.3 Compliance with State Requirements

****
The Contractor should be directed to conform to state well construction and environmental requirements. The responsibility to investigate and evaluate these requirements should be placed on the Contractor (since they are usually local). The Contractor should be required to notify the Government if there is a conflict between state requirements and this SOW.
****

6.1.4 Utility Clearances

****
This section should specify who has the responsibility for obtaining digging permits and utility clearances. Most often, the Contractor is required to obtain all utility clearance and digging permits. This will require coordination with the land owner or installation. They may need to assist the Contractor in obtaining these permits. Cross reference with section 3.5.4 if the Government will assist in obtaining permits. The section should also prescribe acceptable procedures for relocating sampling sites if utilities pose a problem. It may be desirable to request a copy of the permit be included in the RI report.
****

6.1.5 Disposal of Investigation Derived Waste (IDW)

****
This is a difficult topic. This section describes the responsibility for disposal of cuttings, drill fluids, decontamination fluids, development or purge water, pump test water, chemical samples, rock core, and other potentially contaminated material generated in the field. The disposal means and responsibility vary depending on the type of waste, the contaminant, the project, and regulatory atmosphere.

If RCRA Hazardous IDW is to be stored onsite, contact the State RCRA regulators to determine storage requirements. In most instances, the state will require that IDW be stored in accordance with the storage provisions of RCRA for generators which are found in 40 CFR 262 and 40 CFR 264.

This topic requires careful coordination with the project manager, the installation, the state regulators and Treatment, Storage or Disposal (TSD) facility. The analytical lab and project chemists should be consulted for information regarding the disposal of analytical samples after the lab is done with them. Someone familiar with environmental laws and regulations should also be consulted.

This topic should reference the Sample Analyses, Data Assessment and Reporting Section (2.4), particularly those sections describing waste-generating activities such as decontamination, subsurface soil/rock sampling, aquifer testing, etc.

Any additional chemical analyses necessary to make decisions about IDW disposal must be coordinated with the chemist to assure that the numbers of analyses shown in tables accurately reflect this work.

See EPA Guidance Document EPA/540/G-91/009, Management of Investigation-Derived Wastes During Site Inspections, May 1991.
****

6.1.6 Explosive Ordnance Disposal

****
This section would discuss the procedures and responsibilities for disposal of possible ordnance. This activity will require coordination with the Ordnance and Explosive Waste Mandatory Center of Expertise (OEW-MCX) at CEHND, the installation, Explosive Ordnance Disposal (EOD) unit, and local officials (in some instances). This section should be

developed by a safety engineer experienced in ordnance disposal, with the involvement of the project manager and the hydrogeologist.

It is very important to note the type of waste, especially if the production of ordnance was the manufacturing process. In this case, coordination with the state RCRA office may be necessary.
****

6.1.7 Decontamination of Equipment/Tools

****
This topic describes the acceptable procedures for decontamination of the sampling tools, bailers, drill rigs, backhoes, etc. This should be developed in consultation with the chemist and industrial hygienist and should be cross referenced with the Chemistry and Safety and Health Technical Requirements. These procedures would be outlined in the CDAP and the SSHP.

Decontamination fluids are considered investigation-derived wastes!
****

6.1.8 Water Source and Testing

****
If water is required for site activities such as rotary drilling or heaving sand control, the source and testing of this water is described here. The chemist should assist in developing this portion of the scope to assure the analyses of the water from the proposed source is included in the analytical tables. If a source is available on site, this should be noted, but this would require coordination with the land owner or installation. These activities should be described by the Contractor in the workplans.
****

6.1.9 Site Restoration and Protection

****
The Contractor is normally required under this section to restore the site after field work or each hole/pit is completed. Any unusual site protection requirements can be discussed here, such as protecting trees, wetlands, etc. It may be necessary to consult with a biologist or wetlands specialist within the Corps, or with the state regulatory agencies.
****

6.1.10 Contractor Responsibility for Wells

****
This section normally outlines the Contractor's liability for functioning wells and states the Contractor shall replace, at no cost to the government, any well that won't yield the required data because of inadequate design or installation.
****

6.1.11 Site Surveying

****
This section should describe the requirements for developing the surveying data required under Task 3, Field Investigations (2.3). This section should set forth the procedures for a survey of sampling locations (proposed or actual), the determination of the site boundary (a cadastral survey), or the preparation of a site topographic map. The survey should be required to be compatible with previous surveys in the area. If previous surveys were of questionable quality, requirements for the resurvey of features should be considered. The requirements are best determined by a team of the project/technical manager, a surveyor, design engineers, the chemist or hydrogeologist, and possibly a real estate officer. Submittal of appropriate work products and field notes are probably best described here. This section should be coordinated with the land owner or installation, and possibly the local registrar of deeds, etc. Installations often have good topographic information available, but it should be relatively current. Cross reference with paragraph 6.1.2 Applicable Driller and surveyor Permits and Licenses.
****

6.2 Monitoring Well Installation and Drilling Plan (MWIP) Attachment

****
This section specifies the content of the Monitoring Well Installation (and Drilling) Plan. This plan sets forth the rationale and step-by-step plan of action for each field activity, including a description of all equipment and materials, up to the actual handling of samples. Normally, this plan discusses the design and implementation details left to the Contractor, including all field activities up to actual handling of the samples. Materials, construction/drilling procedures, geophysical procedures, aquifer testing methods, etc. are appropriate to be discussed in the MWIP.

This section should be coordinated with the chemist and project manager to make sure the scope adequately conveys the differences in intent for the CDAP and the MWIP so there is little duplication of effort by the Contractor in preparing plans. The MWIP can be presented as a section of the CDAP so only one document addresses field sampling.

Refer to Enclosure 17 for a checklist useful in reviewing a MWIP.
****

6.3 Subsurface Soil/Rock Sampling

****
This section discusses the required or acceptable procedures for drilling boreholes and excavating test pits and obtaining samples for logging and chemical and geotechnical analyses. These sections should discuss the procedures for drilling and sampling, not the locations or numbers of boreholes, etc., since that is discussed under the Project Requirements Section. If not already involved, geotechnical engineer should assist in developing the requirements. The industrial hygienist should assure that the scope requires the Contractor's site safety and health officer evaluate the safety and health hazards associated with drilling boreholes and excavating test pits in accordance with applicable standards and safe procedures.

In some cases, many of the topics under this topic should be written to allow flexibility depending on the Contractor's capabilities or local experience, particularly in choosing drilling or excavation methods. On the other hand, the more detail provided here, the less risk of having procedures proposed in the plans that are unacceptable.
****

6.3.1 Drilling Method
6.3.2 Test Pit Excavation

****
This section should specify where the sampling should be done. In some cases, sidewall sampling by personnel who enter the trench may be appropriate, but in other cases, sampling from the backhoe bucket may be adequate. The industrial hygienist should assure the scope requires that sampling activities performed in close proximity to trenches/excavations and sampling activities requiring entry of personnel into the trenches/excavations shall be performed

only after the evaluation by the site safety and health officer. Special consideration shall be given to the requirements of Section 23 "Excavation" and Section 27 "Work in Confined Spaces" of the USACE Safety and Health Requirements Manual, EM 385-1-1 (latest revision). In addition, the requirements of applicable OSHA standards, such as 1926.650 (Subpart P-Excavations) through 1926.652 (Requirements for Protective Systems) and 1910.120 (Hazardous Waste Operations and Emergency Response), shall be met. Refer also to Enclosure 8 of this ETL.
****

6.3.3 Logging Requirements

****
See Enclosure 14 to the ETL for a list of logging requirements. The logs may be considered a separate submittal which are often required within a certain time following completion of each boring. This allows an early check on the adequacy of the logging and the conditions encountered.
****

6.3.4 Geotechnical Sampling and Analyses

****
This section should discuss the general frequency (number per hole), depth, and/or numbers of samples (if for the entire project) to be taken for geotechnical analyses or logging purposes. The performance of tests such as the standard penetration test or the use of a cone-penetrometer rig should be discussed here. The section should also discuss the required testing to be performed and the appropriate methods for geotechnical testing. This section should be developed with input from the geotechnical engineer. If the geotechnical samples are to be analyzed by a Corps lab (often an economical alternative), careful coordination is necessary with the lab to assure the availability of the necessary equipment and time, as well as to discuss any safety issues related to handling the samples or the disposal of the samples after testing.
****

6.3.5 Coring/Core Handling
6.3.6 Hole Abandonment/Decommissioning

****
This section should discuss the acceptable method of abandoning borings or pits. In some states, grouting of the borings may be required, particularly if they encounter ground water.

The use of cuttings for fill may be allowed if clean (see IDW guidance). Coordination may be required with the federal and state regulatory authorities. The hydrogeologist should develop this section in consultation with a chemist and someone familiar with environmental laws and regulations. Cross reference the section on IDW disposal.
****

6.3.7 Sampling Techniques

****
This section describes the acceptable techniques for obtaining soil samples (or perhaps water samples obtained for screening purposes) directly from the boring or pit for chemical analyses. Note that water samples taken by bailer or similar device directly from the open boring or pit are generally not adequate substitutes for water samples taken from monitoring wells or for water samples taken using specially designed downhole water samplers (e.g. a cone penetrometer, a Hydropunch, or BAT probe). This section should not discuss sample packaging and shipment if these items are to be covered under the Chemistry Technical Requirements. A cross-reference to that section would be appropriate. This section should be developed jointly by the hydrogeologist and the chemist. These requirements should be incorporated by the Contractor in preparation of the CDAP.
****

6.3.8 Field Screening

****
This section would discuss the procedures for measuring and recording the results of the screening of the soil samples by photoionization detector (PID) or flame ionization detector (FID), though it could include other field screening techniques, such as explosives screening. If another agency is performing the field screening (say for a nerve agent or unusual compound), coordination will be required between them and the Contractor. The procedures proposed by the Contractor should be outlined in the CDAP. It is very practical to require that only one technique be used throughout the field effort to assure the comparability of the screening results between sampling locations.
****

6.3.9 Location/Elevation Survey of Boreholes/Test Pits

6.4 Monitoring Well Installation

****
This section discusses the required or acceptable procedures, materials, and design for drilling and installation of the monitoring wells. Generally, the hydrogeologist or geotechnical engineer would prepare this entire section, with consultation with the chemist for issues, such as material choice, which could affect sample integrity.

In some cases, many of the topics under this section should be written to allow flexibility depending on the Contractor's capabilities or local experience, particularly in choosing drilling. On the other hand, the more detail provided here, the less risk of having procedures proposed in the plans that are unacceptable. All procedures should be proposed by the Contractor in the Monitoring Well Installation Plan. Details are given in USACE monitoring well installation guidance.

The materials, such as casing, screen, grout, and filter pack should be treated similar to a construction specification, including specification of size, material, and installation techniques. Materials should be specified based on the site conditions to the extent possible.
****

6.4.1 Drilling Method

****
Acceptable drilling methods should be described here considering site conditions and chemicals of concern. Assuring acceptable data quality but providing the Contractor maximum flexibility should be the goal here.
****

6.4.2 Soil/Rock Sampling While Drilling

****
This section should discuss the sampling of soils during drilling of the monitoring well boreholes. This would generally be done to prepare logs or obtain samples for chemical or geotechnical analyses. Cross reference to the Subsurface Soil/Rock Sampling section. This section should only note the general frequency of soil sampling if it is consistent from site to site; otherwise, this should be discussed in the Project Requirements Section.
****

6.4.3 Field Screening

****
Cross reference to the Field Screening Section under Subsurface Soil/Rock Sampling, unless the field screening procedure

differs for the drilling and sampling for monitoring wells.
****

6.4.4 Casing and Screen
6.4.5 Gravel/Sand Pack
6.4.6 Grouting
6.4.7 Surface Completion

****
This section should discuss the way the well is finished at the surface; i.e., protective casings, locks, flush mount finish, protective posts. This is often a matter of the desires of the land owner or installation and will require coordination with them.
****

6.4.8 Well Development

****
This section should cross reference the section on IDW disposal since significant quantities of contaminated water can be generated.
****

6.4.9 Monitoring Well Construction Diagrams

****
This section would require as-built drawings of the wells as they are completed. These are often separate submittals to be submitted within a specified time following completion of each well. Cross reference with the section on logging for logging of the boreholes.
****

6.4.10 Survey

****
This section requires the elevation and coordinate survey of the new wells and specifies the accuracy. Cross reference with the Site Surveying Section.
****

6.4.11 In-Situ Permeability (Single Well) Testing
6.4.12 Water Level Measurements
6.4.13 Dedicated Pumps and/or Bailers

****
This section should prescribe any dedicated bailers or sampling pumps. This may require input from an environmental or mechanical engineer for appropriate pump selection. If the installation or other agency may be sampling the wells a number of times, coordination may be required to assure the wells meet their requirements.
****

6.4.14 Well Sampling

****
This section discusses the requirements for the sampling procedures. Should also, if appropriate, describe procedures for obtaining samples of floating product. Actual sampling round and analyses should be discussed under Project Requirements.
****

6.5 Existing Domestic/Industrial/Municipal Well Inventory

****
This section would require the compilation of a list of existing wells in the vicinity of the site and various data about them, including use and construction. This may require coordination with the installation or landowner if additional wells are on the same property, but generally the Contractor will be required to contact the various land owners or state or local agencies to obtain this information. This section may require cross reference to the section on Available Data Review (2.1.1). This section would provide the technical requirements for the survey directed under the Available Data Review Section.
****

6.6 Aquifer Tests

****
This section describes the performance of pump tests or other aquifer testing. It is normally to be developed by the hydrogeologist, but because of the difficult issue of water disposal, input from an environmental/process engineer is strongly recommended, particularly if the water produced is contaminated. This has proven to be a serious problem, often

to the point of preventing the performance of an aquifer test until an onsite treatment plant is built.
****

6.6.1 Pump Test Plan

****
This would require a plan for conducting the pumping test(s) and construction of the pump test well(s). It would be a part of/addendum to the MWIP.
****

6.6.2 Pumping Well Installation

****
Refer to the Monitoring Well Installation Section for the typical requirements.
****

6.6.2.1 Drilling Method
6.6.2.2 Soil Sampling While Drilling
6.6.2.3 Field Screening
6.6.2.4 Casing and Screen
6.6.2.5 Gravel/Sand Pack
6.6.2.6 Grouting
6.6.2.7 Surface Completion
6.6.2.8 Well Development
6.6.2.9 Well Construction Diagram
6.6.2.10 Well Survey
6.6.2.11 Initial Water Level Measurements
6.6.2.12 Pump
6.6.2.13 Initial Well Sampling

6.6.3 Observation Well Construction

****
Refer to the Monitoring Well Installation Section for the typical requirements.
****

6.6.3.1 Location(s) and Depth(s)

****
"Locations" would refer to the locations relative to the pumping well, not to the locations of the tests.
****

6.6.3.2 Drilling Method
6.6.3.3 Soil Sampling While Drilling
6.6.3.4 Field Screening

6.6.3.5 Casing and Screen
6.6.3.6 Gravel/Sand Pack
6.6.3.7 Grouting
6.6.3.8 Surface Completion
6.6.3.9 Well Development
6.6.3.10 Well Construction Diagram
6.6.3.11 Well Survey
6.6.3.12 Initial Water Level Measurements
6.6.3.13 Initial Well Sampling
6.6.4 Step Testing of Pumping Well
6.6.5 Pump Test Duration
6.6.6 Water Level Monitoring
6.6.7 Water Sampling During Test

****
This section would specify the frequency of and procedures for sampling during the test. Careful coordination is necessary between the hydrogeologist and the chemist in developing this section. This section should only be used if the requirements for sampling during the test are NOT discussed under Project Requirements. Any samples should be included in the chemical analyses summary tables and methods should be discussed under Sample Analyses, Data Assessment and Reporting Section (2.4). Since the results of these samples are often needed on a quick turnaround basis, an onsite lab may be needed. These requirements need to be carefully cross referenced with the Chemistry Technical Requirements.
****

6.6.8 Water Storage or Discharge/Water Treatment

****
This section presents a serious problem to the performance of aquifer tests at HTRW sites. This section would discuss the requirements for the handling of the pump test water. Given the significant impact on cost, some indication of possible alternatives must be included. This section needs the input of the hydrogeologist, the environmental/process engineer, and a chemist, the industrial hygienist, and possibly the geotechnical engineer. The industrial hygienist would assist in determining potential safety and human exposure problems associated with the handling of the water. The geotechnical engineer would provide input on the scope requirements for foundation preparation of the storage tank or treatment plant. This activity must be coordinated with the installation, the landowner, and possibly a local treatment plant for both disposal of the water and for space for the storage

tanks or treatment plant. Since the water is considered IDW, refer to section 6.1.5, Investigation Derived Waste.
****

6.6.9 Recovery Monitoring
6.6.10 Data Reduction and Analyses

****
This section describes the requirements for analyzing the aquifer test data to develop specified aquifer parameters, such as transmissivity. Because the methods chosen to determine the hydrologic parameters such as transmissivity and storage coefficient depend somewhat on the appearance of the pump test data, flexibility is recommended in the scope. If the results of the analyses are relevant to the section on Ground Water Modeling, this section should be cross-referenced.
****

6.6.11 Aquifer Test Report

****
This section would describe the topics to be presented in a portion or appendix of the RI report that summarizes the aquifer testing program.
****

6.7 Geophysical Surveys

****
This section describes the geophysical survey methodology to be performed. Again, this section does NOT describe the locations, etc. of the surveys since that is discussed under the Project Requirements. This section should be developed by the hydrogeologist or a geophysicist. Only issues such as access should need to be coordinated with the landowner or installation. There may be a possibility that operation of some geophysical instruments could interfere with radar and communications at an installation. This has not been a problem, but this may need to be coordinated with the appropriate shops at the installation.
****

6.7.1 Surface Geophysics

****
Refer to Enclosure 9 of the ETL for a checklist for scoping surface geophysics. The requirements should be

accompanied by rationale for the selection. The topics listed below should be considered.
****

6.7.1.1 Methods to be Considered
6.7.1.2 Plan Preparation

****
This requirement would generally specify the topics to be considered under the portion of the MWIP concerning the surface geophysical surveys. Refer to Enclosure 9 for topics to be covered by the Contractor in the plan.
****

6.7.1.3 Instrument Calibration
6.7.1.4 Survey Grid/Traverse Spacing
6.7.1.5 Measurement Protocol
6.7.1.6 Grid/Traverse Surveying
6.7.1.7 Data Recording
6.7.1.8 Data Processing and Analysis
6.7.1.9 Report and Drawings

****
This section would describe the topics to be presented in a portion or appendix of the RI report that summarizes the geophysical surveys.
****

6.7.2 Downhole Geophysics

****
This requirement would generally specify the topics to be considered under the portion of the MWIP concerning the downhole geophysical surveys.
****

6.7.2.1 Operator Licensing
6.7.2.2 Methods to be Used
6.7.2.3 Plan Preparation

****
This requirement would generally specify the topics to be considered under the portion of the MWIP concerning the downhole geophysical surveys.
****

6.7.2.4 Instrument Calibration
6.7.2.5 Data Recording and Log Scale

6.7.2.6 Data Analyses
6.7.2.7 Report and Log Presentation

****
This section would describe the topics to be presented in a portion or appendix of the RI report that summarizes the downhole geophysical surveys.
****

6.8 Vadose Zone Permeability/Infiltration Testing

****
This section describes the requirements for conducting tests of the hydraulic and air permeability testing of the unsaturated zone. The section should describe the acceptable methods to be considered, if known. In many cases, it may be best to utilize the Contractor's expertise. The reference to ASTM designated methods or similar standards would be useful. These requirements would be developed by the hydrogeologist, the geotechnical engineer, or the project team member preparing the risk assessment. If the testing is to be done to support the development and screening of a remediation or disposal alternative, input from an environmental/process engineer would be advisable. It may also be appropriate to cross reference to the Treatability Studies Section if the testing is done for this purpose.
****

6.8.1 Method
6.8.2 Data Analysis

6.9 Modeling

****
This section describes the requirements for performing ground water, vadose zone, geochemical, surface water, and/or contaminant transport modeling. Since modeling can be done to support many aspects of HTRW work, the requirements presented here may vary widely. In some cases, the use of a specific modeling computer code or analytical solution 'nay be required; in other cases, the better approach may be to provide the intent and general guidelines and allow the Contractor to propose a model in the project plans. The topics listed below can present specifications or only require the Contractor to consider the topics in choosing a code/solution or developing the model. More detailed information on scoping ground water modeling can be found in Enclosure 10 to the ETL.

To develop this section, input must be obtained from the hydrogeologist; however, because the modeling may be done to support risk assessment or remedial design, the team members primarily responsible for those items should provide input as well. Many of the modeling tasks will require knowledge or input of chemical properties and behavior; therefore the chemist should also be involved in preparing this section of the scope.

This section should cross reference to those sections in the main body of the scope that would require modeling support, such as alternative screening or risk assessment. It should also reference the description of the conceptual site model presented in section 1 and required of the Contractor in section 2.1.

Generally, little coordination would be required for this item outside of the coordination between the Corps and the Contractor. However, in some cases it may be necessary or best to use a model (code and input) previously developed for the site, say by the regulatory agency or previous Contractor. In this case, coordination by the Corps may be required to obtain this model.

Modeling efforts must be described in the RI/FS workplan and requirements should be presented in section 2.1 of the SOW. Reports are required for each modeling effort by specific sections under this topic. These sections would contain language that require the reports to be prepared and describe the topics to be presented. These reports could be combined if more than one modeling effort is required (say one for risk assessment and another for alternative screening) and would be most appropriate as an appendix to the RI or the FS, depending on the purpose. These sections on the modeling reports should be developed by the hydrogeologist and cross referenced with the submittal requirements to assure consistency under the Submittals Section.
****

6.9.1 Ground Water Transport
- 6.9.1.1 Purpose and Rationale
- 6.9.1.2 Review of Previous Models
- 6.9.1.3 Area to be Modeled
- 6.9.1.4 Type of Model
- 6.9.1.5 Boundary Conditions
- 6.9.1.6 Calibration
- 6.9.1.7 Scenarios to be Considered
- 6.9.1.8 Modeling Report

6.9.2 Contaminant Transport

****
This could include contaminant transport in the ground water or vadose zone.
****

6.9.2.1 Rationale
6.9.2.2 Review of Previous Models
6.9.2.3 Area to be Modeled
6.9.2.4 Type of Model
6.9.2.5 Boundary Conditions
6.9.2.6 Assumptions
6.9.2.7 Calibration
6.9.2.8 Scenarios to be Considered
6.9.2.9 Modeling Report

6.9.3 Vadose Zone Air Flow

****
This could include subsurface gas generation or transport modeling for risk assessment or soil vapor extraction system feasibility evaluation.
****

6.9.3.1 Rationale
6.9.3.2 Review of Previous Models
6.9.3.3 Location
6.9.3.4 Type of Model
6.9.3.5 Boundary Conditions and Assumptions
6.9.3.6 Calibration
6.9.3.7 Scenarios to be Considered
6.9.3.8 Modeling Report

****
This would require a report on the modeling effort. This could be part of the FS report.

****

6.9.4 Geochemical Modeling

****
The work required here is different from the contaminant transport modeling. These models would include those done to evaluate impacts on facilities or the aquifer by inorganic precipitation or biofouling, for example.
****

6.9.4.1 Rationale
6.9.4.2 Type of Model
6.9.4.3 Scenarios to be Considered
6.9.4.4 Modeling Report

****
This would require a report on the modeling effort. This would be part of the FS report.
********** ********

6.9.5 Surface Water Modeling

****
This section describes the required methodology and criteria for surface water modeling to support the screening of alternatives or to identify surface water impacts under NEPA. This section would be prepared by a hydrologist if only local drainage is involved. If stream flow is involved additional help would be required from experts in sediment transport and/or in water quality.
****

6.9.5.1 Local Drainage or Flood Flows

****
This section would describe the necessary procedures to perform simulation of local drainage and flood flows. In the area of flood frequency the following categories of flood data are recognized: systematic records (U.S. Geological Survey gaging stations), historic data (high water marks and newspaper accounts), comparison with similar watersheds (regional frequency studies), and flood estimates from precipitation (HEC-l analysis). Bulletin #17B, March 1982, prepared by the Interagency Advisory Committee on Water Data and published by The U.S. Department of the Interior, Geological Survey, Office of Water Data Coordination, Reston, Virginia 22092 provides the necessary guidance for evaluating data in the first two categories. Guidance for comparing similar watersheds is provided in EM 1110-2-1415, while guidance for making flood frequency estimates from precipitation is provided in the Corps' Hydrologic Engineering Center's (HEC) Training Document No. 15, entitled "Hydrologic Analysis of Ungaged Watersheds Using HEC-1, April 1982. The latter two publications are available from HEC, 609 Second Street, Davis, California 95616. In all cases, a basin description along with a basin map should be provided.

A HEC-2 backwater model should be used in conjunction with the flow frequency results to determine stages and flow velocities associated with all pertinent floods (normally these are the 500-,100-,50-,25-,10- and 2-year events) at the site under investigation. A publication entitled "Accuracy of

Computed Water Surface Profiles", December 1986 prepared by HEC for the Federal Highway Administration provides a basis for determining the type of field surveys required to set the upstream and downstream boundaries for the study, the level of topographic detail needed to get good cross section definition, and a methodology for improving the reliability of estimating Manning's coefficient when calibrating the model to high watermarks. This publication is available from HEC. The Contractor cannot obtain the HEC-2 model directly from HEC. The scoping district can provide the model to the Contractor or the Contractor can obtain commercial software. Cross reference the section on Flood Frequency/Flood Plain Analysis (Section 2.10.6.2).
****

6.9.5.2 Continuous Flow Simulation

****
This section would require the Contractor to perform continuous flow simulations. Continuous flow simulation of a riverine system can be helpful in measuring the impacts of a proposed project on the flow regime in the basin. If long term gaging records are to be used to set up the simulation model, appropriate adjustments need to be made to the historic flow records to make them consistent with baseline conditions (pre-project). Selection of an appropriate time-step (either monthly or daily) will depend on the available data and the accuracy required to make the NEPA impacts assessment.
****

6.9.5.3 Sediment Transport

****
This section would describe the simulation and analysis of sediment transport. When a flow regime is changed, the dynamic balance between sediment movement and the hydraulics of flow is upset. A land-use change can impact the size and gradation of sediment material in the stream's boundaries which can also be a contributing factor to upsetting this dynamic balance. The interaction between the hydraulics of flow and the rate of sediment transport can be simulated with HEC-6, a one-dimensional numerical model of river mechanics. It was developed by the Hydrologic Engineering Center in Davis, California. One of the input parameters to this model is an estimate of the sediment material in the stream's boundaries. Actions proposed for the site involving a land-use change that could vary this input parameter can be

assessed by applying the Soil Conservation Services's Universal Soil Loss equation.
****

6.9.5.4 Water Quality

****
This section would require the simulation of surface water quality impacts. In the practical applications of water quality models, uncertainty in the input data is usually a major limitation. The pathways and ultimate fates of heavy metals and chlorinated organics through the ecosystems are often not fully understood. However, the United States Environmental Protection Agency through its water quality modeling program has modeling packages available that can be useful in screening alternative options.
****

6.10 Fracture Trace Analysis (FTA)

****
This section describes the procedures to be used to develop an analyses of bedrock jointing and faulting and its relationship to ground water flow paths. This work is sometimes scoped to support decisions and conclusions related to plume migration and monitoring. The hydrogeologist would develop this section.
****

6.10.1 Imagery to be Used

****
This section would require the number and type of air photos, satellite imagery, or even other information (such as aeromagnetics or side looking radar) to be used in the analysis. This section would also specify who is responsible for obtaining or providing the imagery.
****

6.10.2 Ground Truth/Verification

****
This section would describe the requirements for field work to verify or correlate the images seen on the imagery with the nature of the bedrock in outcrops or cores.
****

6.10.3 FTA Report

****
This section would describe the content of the report. Generally, this report would be required as an appendix to the RI.
****

6.11 Miscellaneous Methodologies

****
This section describes requirements for activities which may vary in procedure significantly depending on site characteristics or project objectives. Detailed requirements should be developed for these activities based on these factors.
****

6.11.1 Soil Gas Survey Methodology

****
There are several ways to obtain soil gas samples. The sections of the scope under this topic would depend on the technique to be used. In many cases, it may be sufficient to specify only active or passive soil gas sampling and leave the details of the method to the Contractor to propose in the plans. The topics listed below are only typical for an active system. This section should be developed jointly by the hydrogeologist and the chemist and careful cross-referencing is necessary to the other chemistry-related sections for definition of the analytical procedures to complement these requirements for sampling procedures. The team should keep in mind that physical site properties, including soil types and surface features, can affect the applicability of soil gas sampling.
****

6.11.1.1 Probe Design and Placement
6.11.1.2 Probe Purging
6.11.1.3 Sample Recovery
6.11.1.4 Decontamination of Equipment
6.11.1.5 Blank, Background, and Duplicate Samples

6.11.2 Tracer Studies

****
This section would describe the procedures for performing tracer tests to determine ground water flow paths and rates, develop dispersivity estimates, or to verify leaks in site utilities. The requirements would vary widely depending on the site conditions and the intent, but could include the tracer compound, measurement of concentration/observation

points, analyses of data, and method of introduction of tracer. This section should be developed by the hydrogeologist and chemist (with input from the process engineer if related to site utilities).
****

6.12 Geographic Information Systems (GIS)

****
This section describes requirements for the use of GIS in managing the site data generated by field and historical investigations, if appropriate. These activities generate a large amount of raw data, such as chemical data, stratigraphic data, property/land use information that can be handled efficiently with GIS. If there are many sites at an installation, a GIS can help track data from all sites to coordinate evaluation of the overall problems. This section should be prepared by the project manager, hydrogeologist and chemist considering the nature of the project and the customer needs. This section can require the use of a specific GIS or leave the choice to the Contractor. The use of the GIS should be documented in the project workplans.
****

7. Air

****
This section presents the technical requirements for performance of activities associated with air impact assessments. Enclosure 16 presents a general description of air impact assessments for those not familiar with the process.

The level of detail to be included in the scope depends on the project and the Contractor's experience in performing air monitoring and modeling as well as the Contractor's experience in working with the Corps.

The language for each topic should be developed by the individual(s) responsible for air monitoring and air modeling with input and concurrence from the chemist, industrial hygienist, process engineer, and risk assessor (if these individuals do not have direct responsibility for air tasks).

Most of the following sections require some description of the Contractor's proposed implementation in the workplans. Details related to sampling and analysis of ambient air and emission rates are to be included in the CDAP. Details related to industrial hygiene type air monitoring are to be included in the SSHP. Other activities such as

meteorological monitoring, estimation of emission rates using modeling, and atmospheric dispersion modeling may require separate submittals which should be described in this section.

In general, many of these sections should be cross referenced to the Health and Safety Technical Requirements (Section 4); the Chemistry Technical Requirements (Section 5); the Sample Analyses, Data Assessment and Reporting section (2.4); the Data Evaluation/Fate and Transport Analysis section (2.5); and the Detailed Analysis of Alternatives section (2.10). There should be no duplication with the Field Investigations section (2.3).
****

7.1 Ambient Air Monitoring/Sampling

****
This section would provide additional details on the performance of ambient air monitoring/sampling. It is probable that most details will be described in the health and safety and chemistry sections (4 and 5, respectively). If additional requirements are needed, they would be described here. One example might be details for construction of ambient air monitoring stations.
****

7.2 Meteorological Monitoring

****
This section would discuss the decision to use available meteorological data or to obtain onsite data. If onsite data is desired, details on siting a meteorological tower, equipment specifications, data collection, processing, and reporting would be included here. This section should cross reference section 2.3.11.
****

7.2.1 Review Available Data
7.2.2 Onsite Monitoring
7.2.2.1 Meteorological Tower
7.2.2.2 Data to be Collected
7.2.2.3 Data processing, Documentation and Reporting

7.3 Emission Rate Measurements

****
This section would discuss procedures for measuring emission rates at undisturbed sites for use in the baseline risk

assessment. Procedures for determining emission rates from various remedial alternatives would also be discussed. If pilot scale tests will be performed, emission rates may be measured to assist in evaluating the impacts from full scale operations. Various techniques, both screening and in-depth, may be described. Some techniques are flux chambers, soil vapor techniques, wind tunnels, head space samplers, sampling stacks, vents, ducts, etc. This section should only discuss details that have not been covered elsewhere, i.e., Chemistry Technical Requirements (section 5), and should cross reference appropriate sections.
This should not duplicate requirements described in section 2, but should provide additional details on how to perform the required measurements.
****

7.4 Emission Rate Estimates

****
If emissions cannot be measured, this section would discuss details for estimating emission rates. If desired, this section could require the use of specific models for estimating emissions from different sources and activities such as lagoons, landfills, land treatment, materials handling, process emissions, leaks and spills on soils, etc. Alternatively, the decision on which model to use could be made by the Contractor and described in appropriate workplans or other submittals.
****

7.4.1 Uncontrolled Emission Sources
7.4.2 Remedial Action Sources
7.4.3 Emission Models
7.4.4 Emission Factors

7.5 Atmospheric Dispersion Modeling

****
This section would discuss additional details for atmospheric dispersion modeling performed as part of the fate and transport analysis (Task 5) and the detailed analysis of alternatives (Task 10). The level of detail will depend on the Contractor's experience. In some cases, the use of a specific model may be required, in other cases, the better approach may be to provide the intent and general guidelines and allow the Contractor to propose a model in the project plans. The topics listed below can present specifications or only require the Contractor to consider the topics in choosing a model.
****

****
This section would describe any other requirements for the Contractor.
****